Estimating the cost of mitigating coal labour losses in SA's energy transition

by

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Declaration

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Abstract

Can normative just transition concepts and frameworks contribute to the mitigation of labour losses during South Africa's energy transition? This thesis explores conceptual and methodological frameworks as well as context-based approaches to a just transition in the interest of coal workers' livelihoods.

Rather than assuming that just transition strategies from the global north, are automatically applicable in South Africa, these approaches are applied to the local context. The study recognises data gaps, South Africa's current energy crises and the window of opportunity provided by the current political discourse which acknowledges the need for a just transition in South Africa. In regard to data gaps, it is clear that reliable labour data is needed to calculate the cost of a just transition and inform labour risk mitigation strategies, thus providing a more rational basis for a managed just transition.

In exploring just transition approaches, this study combines an analysis of global just transition strategies through a literature review, the application of a framework to calculate the cost of a just transition, and qualitative, context-based observations of communities in Emalahleni.

The research reveals that sequenced policies that include regional and sectoral development are the most effective way to prevent job losses and also revealed approaches concerning degrees of social protection. It finds that early retirement and attrition programmes are effective ways to ease transitions as they are successful in reducing unemployment. A cost-scoping approach highlighted the impact of varying contraction rates and corresponding risks for unmanaged transitions. A quantitative cost analysis indicated 'blind spots', such as securing pension guarantees, compensation costs for reduced salaries and relocation costs, that have not commonly featured in the mainstream just transition literature.

Qualitative observations in Emalahleni revealed the communities' desire for 'clean' and safe jobs; the divisive impact that the coal workers' demand for jobs has on community culture, as well as their collective desire to be involved in the rehabilitation of mining areas. The observations show how social structures are

emerging and self-organising, with a specific focus on locally-owned energy systems. Interviews with regional energy experts confirmed that regional and sectoral development plans can flourish, and that existing coal workers can be successfully retrained and reskilled as well as the responsibility to extend a just transition to future generations. The interviewee stressed the need for innovative, integrated education systems that address the challenges of existing school systems.

The combination of theoretical frameworks, global practice and context-based approaches, connect innovative, local opportunities to the unlimited potential of the broader community in the Nkangala and Gert Sibande municipal districts. While social infrastructure is emerging in this community, further strengthening of these structures and collaborative and inclusive processes will enable the creation of a suitable theory of change.

Opsomming

Kan normatiewe regskonsepte en raamwerke moontlik bydra tot die versagting van arbeidsverliese tydens SA se energie oorgang? Hierdie tesis ondersoek konseptuele en metodologiese raamwerke en konteks-gebaseerde benaderings tot 'n regverdige oorgang in die belang van die lewensbestaan van steenkoolwerkers.

Hierdie beskermings maatreëls word in 'n plaaslike konteks toegepas, eerder as om aan te neem dat strategieë van die globale noorde, outomaties van toepassing is. Die studie erken navorsings tekortkominge, SA se huidige energie-krises en moontlike politieke wil om 'n regverdige oorgang te bevorder en behoop om oorgangsplanne in te lig met navorsingsinsigte. Betroubare arbeidsinligting wat vaardighede insluit, word benodig om die koste van 'n regverdige oorgang te bereken. Navorsing is noodsaaklik om arbeidsrisiko en versagtingsstrategieë in te lig, en verskaf ‘n meer rasionele basis vir die bestuur van die energieoorgangs.

Hierdie tesis kombineer internasionale regverdige oorgangsstrategieë, die toepassing van 'n raamwerk om die koste van 'n regverdige oorgang en konteks-gebaseerde benadering te bereken en waarnemings van gemeenskappe in Emalahleni om hulle ervaringe te verken.

Die navorsing het gevind dat opeenvolgende beleide, wat plaaslike en sektorale ontwikkeling insluit, is die mees doeltreffende manier om werkverliese te verhoed en het ook grade van sosiale beskerming aan die lig gebring. Tweedens, het dit gevind dat vroeë aftrede en beperkte uitvloei programme bewys-effektiewe maniere is om gladde oorgange te verseker en het aanvaarbare resultate in die vermindering van werkloosheid getoon. Die bepaling van kostes, het die impak van verskillende inkrimpingskoerste en ooreenstemmende risikos vir onbeheerde oorgange beklemtoon. Verder het dit blinde kolle verlig wat nie gewoonlik in oorgangs-literatuur verskyn nie soos pensioen waarborge, die beveiliging van vergoedingskoste vir verminderde salarisse en hervestigingskoste.

Kwalitatiewe gemeenskapswaarnemings in Emalahleni weerspieël 'n begeerte vir besoedelings-vry en veilige werk, die verdelende effek op werkers se gemeenskap, ’n uitwerking van werksgeleenthede op gemeenskapskultuur en ‘n visie om betrokke te

wees in die rehabilitasie van myngebiede. Die waarnemings gee insae tot opkomende sosiale strukture wat besig is om te self-organiseer met ‘n verlange vir plaaslik besit van energie infrastruktuur. Verdere onderhoude met plaaslike energie kundiges het bevestig dat plaaslike en sektorale ontwikkelingsplanne noodsaaklik is, die opleibaarheid en vaardigheidsvlakke van steenkoolwerkers sowel as die verantwoordelikheid om 'n regverdige oorgang na toekomstige geslagte te verleng asook die behoefte aan innoverende, onderwys stelsels wat tegniese en hoër onderwys integreer en die fondamente uitdagings van bestaande skoolstelsels aanspreek.

Die kombinasie van teoretiese raamwerke, internasionale praktyk en konteks-gebaseerde benaderings verbind innoverende, plaaslike geleenthede aan die onbeperkte potensiaal van 'n wyer gemeenskap in die Nkangala en Gert Sibande munisipaale gebiede. Terwyl sosiale infrastruktuur opkomend is in hierdie gemeenskap, sal verdere versterking van hierdie strukture, samewerking en inklusiewe prosesse van die ontwerp 'n geskikte teorie van verandering in staat stel.

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List of Acronyms and Abbreviations

ABET	Adult basic education and training
AET	Adult education and training
AIDC	Alternative Information and Development Centre
ANC	African National Congress
AML	Abandoned Mine Land programme
AUS	Australia
AUD	Australian dollar
B-BBEE	Broad-based black economic empowerment
BC	British Council
BFAP	Bureau for Food and Agricultural Policy
BRICS	Brazil Russia India China South Africa
CAD	Canadian dollar
CBD	Central business district
CBI	Confederation of British Industry
CHIETA	Chemicals Industry Education Training Authority
CEE	Climate energy and environment
CENIFER	Centro de Referencia Nacional en Energías Renovables y Eficiencia Energética
CEO	Chief executive officer
CER	Centre for Environmental Research
CET	Community education and training
C02	Carbon dioxide
CBO	Community-based organisation
CLS	Community learning centre
COP	Conference of the parties
COSATU	Congress of South African Trade Unions
CPUT	Cape Peninsula University of Technology
CRT	Coalfields Regeneration Trust

CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DHET	Department of Higher Education and Training
DOE	Department of Energy
ED	Economic development
EIUG	Energy Intensive User Group
EME	Exempt micro enterprise
ERC	Energy Research Centre
ESETA	Energy Education Training Authority
ESKOM	Electricity Supply Commission
ETUC	European Trade Union Confederation
EU	European Union
EUR	Euro
EUSP	Energy Utilities Skills Plan
FEI	Family Employment Initiative
GDP	Gross domestic product
GEPF	Government employee pension fund
GENZ	Generation Z
GHG	Greenhouse gas
GIZ	Deutshe Gessellschaft für Internationale Zusammenarbeit GmbH
GVA	Gross value-add
GW	Gigawatts
HEI	Higher education institute
HED	Higher education
HR	Human resources
HVET	Higher vocational education and training

ICTJ	International Centre for Transitional Justice
IDZ	Industrial development zone
ILO	International Labour Organisation
IPCC	Intergovernmental Panel for Climate Change
IPP	Independent Procurement Programme
IRP	Integrated Resource Plan
ITUC	International Trade Union Confederation
JHB	Johannesburg
KZN	KwaZulu Natal
LVA	Latrobe Valley Authority
LED	Local economic development
MD	Managing director
MEC	Minerals energy complex
MERSETA	Manufacturing, Engineering and Related Services Sector Education and Training Authority
MPF	Mineworkers Provident Fund
MQA	Mining Qualifications Authority
OECD	Organisation for Economic Co-operation and Development
PALS	Public adult learning centres
PHEIs	Private higher education institutions
PR	Public relations
NALEDI	National Labour and Economic Development Institute
NBI	National Business Institute
NCV	National Certificate Vocational
NDC	Nationally determined contribution
NDP	National Development Plan
NEC	National Executive Committee

NEETS	Not in education, employment or training
NERSA	National Energy Regulator of South Africa
NGO	Non-government organisation
NPC	National Planning Commission
NRW	North Rhine Westphalia
NSFAS	National Student Financial Aid Scheme
NSF	National Skills Fund
NUM	National Union of Mineworkers
O&M	Operations & Maintenance
POPI	Protection of personal information
PPD	Power proportional distribution
QSE	Qualifying small enterprise
RBCT	Richards Bay Coal Terminal
RE	Renewable energy
REC	Renewable energy certificates
R&D	Research and development
REDZ	Renewable energy development zones
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SADTU	South African Democratic Teachers Union
SAHRC	South African Human Rights Commission
SANEDI	South African National Energy Development Institute
SARETEC	South African Renewable Energy Technology Centre
SA	South Africa
SAWEA	The South African Wind Energy Association
SEA	Sustainable Energy Africa

SED	Socio-economic development
SETA	Sector Energy Training Authority
SEI	Stockholm Environmental Institute
SEZ	Special economic zone
SLP	Social and Labour Plan
SPV	Special purpose vehicle
STATS SA	Statistics South Africa
STEM	Science technology engineering maths
TFR	Transnet Freight Rail
TIPS	Trade and industrial policy research
TNPA	Transnet National Ports Authority
TRC	Truth and Reconciliation Commission
TUED	Trade Unions for Energy Democracy
TVET	Technical vocation education and training
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UJ	University of Johannesburg
UK	United Kingdom
US	United States
WEF	World Economic Forum

Chapter 1: Introduction

1.1 Contextualising the research

South Africa has a unique opportunity to be the first coal-based economy in the global south to successfully transition to renewable energy — the energy source of the 21st century. South Africa is also unique because it has an ageing fleet of coal-fired power stations that must be decommissioned over the next 20 years. The country has no choice: it must build more energy generation capacity to offset the closures.

The rationale for an energy transition from coal to renewables can be traced back to South Africa's Nationally Determined Contributions (NDCs) as part of the Paris Accord that spells out a Peak-Plateau-Decline trajectory for its carbon emissions. On the domestic front, the Integrated Resource Plan (IRP) 2019 – 2030 commits South Africa to a decarbonisation pathway hinging on the decommissioning of coal-fired power stations and the rapid uptake of renewable energy.

But, what will the cost of this energy transition be? This research outlines a first empirical study to determine the cost of a just transition for coal workers in South Africa, that would prioritise worker support, stimulate regional development and advance a transition to a low-carbon economy.

Normative concepts such as a just transition may be useful to inform a strategic and locally relevant just transition plan, while ensuring that the rights of vulnerable workers and communities are protected. At the same time, just transition frameworks may reveal pathways to sustainable economies and the necessary policy approaches to ensure that climate change risks are mitigated.

National labour data from South Africa was applied to an international just transition framework developed by Pollin and Callaci (2019). The 20-year cost framework identified attrition and contraction rates that protect coal workers' livelihoods under various scenarios, as many of them are forced to exit this declining industry, either through retirement or the migration to other employment sectors.

The research estimates costs for compensation, retraining, relocation and regional development. Compensation and retraining costs were calculated using coal workers'

education profiles, an assessment of future skills in a mixed green economy as well as occupational profiles to assess skills transferability. It examines sector shifts in employment profiles from permanent to contract workers, investment trends in managing provident funds, a long term decline in retirement fund membership, increased retrenchments and the implications for securing pension guarantees.

The research highlights that empirical data, specifically the interaction between decommissioning, contraction and attrition rates have significant implications for cost estimates. An interrogation of this data and the corresponding just transition scenarios has the potential to inform critical policy choices and implementation strategies to advance South Africa's energy transition.

While South Africa's ageing coal fleet compounds a sustained energy crisis and high unemployment rates continue to rise, the country cannot afford the spiralling cost of an unplanned, unjust transition. Aligning just transition investments with corresponding decommissioning rates could smooth transitions and prevent the risk of amplifying climate instability.

This research outlines various energy transition scenarios, costs and details strategies to support workers and stimulate regional development. Furthermore, it details various policy recommendations, including the institutional mechanisms required to facilitate this just transition process in South Africa. Lastly, it expands on avenues for future research and how this first just transition framework might be applied in other contexts to support energy transitions in the global south.

1.2 Background

Through my learning journey at the Sustainability Institute, during the Renewable Energy Policy module, I became aware of the potential that lenses such as transformative justice and the just transition paradigm have to address inequality and eradicate poverty in energy transitions. At the same time, I was aware of the constraints within the South African political economy and how these were likely to impact an energy transition in South Africa. During the course of my studies I

therefore developed an interest in how these tensions could be navigated in the interest of justice.

Although the concept of a just transition has expanded to address energy access, climate change and job losses (Newell & Mulvaney 2013), this research is primarily concerned with the mitigation of job losses during a transition from coal to renewable energy sources. These concepts will be outlined in more detail in the literature analysis.

When considering approaches to mitigating labour loss in SA's energy transition, this review will evaluate approaches, frameworks and practices from various countries undergoing similar transitions. At the same time, it is essential to consider a context-based approach for South Africa, which is adapted to factor in South Africa's specific regional dynamics, its particular history and socio-economic challenges, such as very high unemployment rates (UNFCCC 2016).

The research draws on local and global research which includes overarching technical guidelines, frameworks and reports to support the achievement of climate change goals, as well as local coal sector reports and publications featuring pathways to a just transition in South Africa.

In addition, an analysis of the relationship between the mining and energy 'economies', the geographical locations of mines, and the rights of mining communities to health and compensation are considered. As is the recent trend towards divestment from coal and its likely impact on potential energy pathways.

The 'just transition' concept is concerned not only concerned with workers' rights, but also with the well-being of the broader community (Smith 2017; Jenkins et al. 2016; Sovacool and Dworkin 2014). This inclusive emphasis assumes community participation in decision-making processes, public dialogue, and the generation of consensual policy mechanisms designed to create enabling environments for new industries, to encourage local economic growth (Dominish et al. 2019).

While the risks of climate change are increasingly unavoidable, many social and economic challenges, such as unemployment, remain unresolved. Globally, the number of unemployed people increased from 170 million in 2007 to 192 million in 2018 (ILO, 2019). The 2008 global financial crises resulted in an upward trend in

unemployment. Although the trend of rising unemployment appears to have stabilised in the past three years, it remains elevated.

Prioritising the mitigation of job losses

The concepts of decent work and economic growth align with Sustainable Development Goal 8 of the UN's Agenda for Sustainable Development. According to the UNFCCC (2016), 40 million new jobs per year will need to be created by 2030 to align with predicted population growth. However, "uncontrolled climate change will not only compromise the ability of counties to achieve this goal, but it could also reverse gains in economic prosperity, social progress and poverty reduction (UNFCCC 2016:14)". In their analysis, they highlight the particular vulnerability of the agricultural sector, which as one of the biggest employers is likely to be severely impacted by climate change.

South Africa has one of the highest unemployment rates in the world, standing at 29% in 2018. This figure has grown yearly over the last decade, increasing from 22,4% in 2008. This rate translates to 6,7 m of the 22,6m labour force being unemployed in 2018. The expanded unemployment rate, which includes people who can work but have stopped looking, is at 38,5%. The percentage of unemployed youth (aged between 15-34) recognised as not being in education or training for employment (NEETS) rose to 40,3% in 2019 (Statistics SA 2019).

Economists suggest that poor education policies are a significant contributor to the unemployment rate (GroundUp 2019) arguing that although there are jobs available, only 1,7% of unemployed South Africans have tertiary education making most unemployed South Africans unsuitable for many job opportunities. Academic research indicates that the combination of a decrease in economic growth and increase in population growth has resulted in increased unemployment (Bell 1984) and that this qualifies why new entrants to the market struggle to find jobs (Beall, Crankshaw & Parnell 2000).

Since 2008 the financial services sector has created over 620 000 jobs while the manufacturing sector has shed 300 000 jobs, and mining 65 000. Given that traditional sectors such as mining and manufacturing are shedding jobs, specific

targeted interventions are necessary to ease these structural labour market changes. Since this data was released, the mining sector announced that it may have to shed a further 90 000 jobs following electricity tariff increases made by Eskom and approved by NERSA (Moneyweb 2019).

These systemic problems of education, unemployment and climate change are further impacted by wider macroeconomic trends such as the increased use of automation and artificial intelligence (the fourth industrial revolution), as well as the overall slowdown in the global economy since 2008.

In February 2019, the Congress of South African Trade Unions (COSATU) embarked on a "Jobs for All" strike following a national Jobs Summit in October 2018. According to COSATU (2018), the strike was a reminder of the commitment government and business made to investigate alternatives to job cuts within the context of SA's context dire unemployment crises. During the strike, the federation opposed the unbundling of the national power utility Eskom and job losses due to automation. It indicated that further protests would continue to take place ahead of the South African general election.

This analysis of unemployment in SA has highlighted the 'connected' and systemic nature of the challenges. In addition, it has also revealed that opportunities exist to better align skills and education priorities to those being demanded by the twenty-first century economy. Given the loss of jobs in traditional sectors like manufacturing and mining, it is clear that government and business need to mitigate these job losses in South Africa carefully.

When considering approaches to mitigating labour loss in SA's energy transition, it is therefore essential to consider a context-based approach which takes into account the socio-economic challenges of unemployment and skills development in South Africa.

Spatiality of SA's coal mines

Over 80% of the mines that supply Eskom's coal plants are located east of Johannesburg, in Mpumalanga province, where mining is the most significant contributor to gross domestic product (GDP) (TIPS 2016).

There is also a relatively small concentration of mines located near Lephalale in Limpopo province (north of Mpumalanga), which employs 3 400 workers or 4% of the total coal workforce.

A transition to a low carbon economy will result in job losses in coal mines, power stations, and the coal transportation sector, and a concomitant decline in municipal revenues and local economies (Strambo et al. 2019). According to the Stockholm Environmental Institute:

> Managing these risks is essential for gaining social acceptance and reducing resistance towards these transformations, and for making sure that poverty and inequality already significant in mining areas are not deepened by an unplanned transition (Strambo et al. 2019:4).

In 2013, 72% of mining gross value-add (GVA) and 58% of utilities GVA in Mpumalanga came from a single district municipality (Nkangala). A further 23.7% of mining GVA and 24% of services GVA came from the Gert Sibande District Municipality (Mpumalanga Provincial Treasury 2015).

The regional distribution of services output suggests that transition planning would need to focus on the towns of Emalahleni, Steve Tshwete and Govan Mbeki. Available data pinpoints these three towns within the municipal districts of Nkangala and Gert Sibande.

Table 1: Coal mining by municipal area (Source: TIPS 2016)

Location	**Province**	**% Contribution**	**No of workers**
Mpumalanga	Mpumalanga	80%	70364
Nkangala District Local municipalities: Emalahleni (Emalahleni) Steve Tshwete (Middleburg)	Mpumalanga	72% of mining GVA 58% of utilities GVA 38% of GVA	49162
Gert Sibande District Local Municipalities: Govan Mbeki (Secunda)	Mpumalanga	23% of mining GVA 24% of utilities GVA	20804
Lephalale	Limpopo	5%	4 000

Coal mining accounts for about 5% of Mpumalanga's formal workforce (Mpumalanga Provincial Treasury, 2015 cited in Strambo et al. (2019),). The main sectors contributing to Mpumalanga's gross value added (GVA) are mining,

manufacturing (mostly heavy industry), construction, and agriculture (TIPS 2016). These sectors may have relevance as-hoc employment options prior to alternative industries being in place. In Mpumalanga, language use can be mapped using data from Stats SA (2019) against a language distribution map of the former homelands located closest to the province. Black citizens were forced to live in homelands during the Apartheid era.

In Mpumalanga:

- 30% of people speak siSwati, the language of neighbouring (Swaziland)
- 26% speak isiZulu, the language of the former homeland of KwaZulu, now located in KZN province
- 10,3% isiNdebele, originates from KwaNdebele homeland now located in Gauteng
- 10,2% Northern Sotho, originates from Lebowa homeland, now known as Limpopo
- 11,6% Xitsonga, from the Lebowa homeland otherwise known as the Limpopo River valley (Limpopo/Mpumalanga)

The language profile suggests that the population of Mpumalanga includes communities who have migrated. Compared to other provinces the profile is unique. For example, in nearby Gauteng, the highest languages are isiZulu (19.8%), English (13,3%), Afrikaans (12,4%), Sesotho (11,%6), Sepedi (10,6%). Similarly, provinces located further afield such as the Eastern Cape include IsiXhosa (77%), Afrikaans (10,4%), English (5,5%), Sesotho (2,4%) and Sign Language (0,6%).

This profile is significant when considering where coal workers' dependents are located and where they might consider relocating to if the coal industry were to transition fully. Coal miners each typically support between three and 5 dependents (Mpumalanga Provincial Treasury 2015). Social and labour Plans indicate that the number may be higher and that workers support up to 10 dependents (Kuyasa SLP 2013).

1.3 Problem Statement

While the global transition to a low carbon economy is gaining momentum, South Africa's transition is showing signs of progress, following a sustained energy crisis. However just transition plans to mitigate job losses in the coal sector still need to be developed. Limited social power and shifts in the balance of power resting with the political elite compounds the problem of a lack of implementation plans.

However, recent developments suggest that there is now high-level agreement between government, unions and business that South Africa's energy production must transition away from fossil fuels in a just and sustainable manner. It is hoped that this will lead to the creation of properly funded and coherent transition policies and initiatives . However, as the transition accelerates workers facing job losses, their respective communities and coal companies, will face significant challenges and vulnerabilities. Reliable and comprehensive data is required to provide insights and inform labour risk mitigation strategies and provide a rational basis for the implementation of a just transition (Steyn, Burton, Steenkamp 2018). Research has shown that just transitions can be successfully implemented if local contexts are fully taken into account (UNFCCC 2016). There is, therefore, an opportunity to explore the usefulness of established just transition strategies in mitigating the risk of labour losses in South Africa's energy transition.

1.4 Research Questions

Research question

What is the usefulness of just transition strategies in mitigating labour losses in South Africa's energy transition?

1. What is a just transition and how is it applied to energy transitions?
2. What are the costs and considerations of worker transition strategies in the coal sector?
3. How can a just transition be applied to mitigate labour losses?

1.5 Rationale for the Study

Reliable and comprehensive data is required to analyse labour risk mitigation strategies and provide a rational basis for the implementation of a just transition. The introduction has indicated that data gaps exist. While the global energy transition is already in motion, the threat of job losses in the coal sector is a concern for many scholars. (Hirsch, Matthess & Fünfgelt (ed.) 2017; McCauley & Heffron 2018; Page 2016; Pollin & Callaci 2019; Steyn, Burton & Steenkamp 2018; Burton, Caetano & McCall 2018, Sweeny & Treat 2018). Acknowledgement of this risk is crucial for planning and managing a just and sustainable energy transition process.

Plurality and contradictions characterise the energy sector and opposing pro-fossil fuel and pro-renewable players each actively pursue their interests. This is expressed by the Minerals Council's statement at the Mining Indaba in 2020.

> The move away from coal would have to be gradual because coal-fired power stations remain necessary for baseload power provision. At present, renewable energy, such as solar and wind power, cannot provide the kind of certainty energy-intensive users in the mining industry require. (Minerals Council 2020)

The proposed research is in the interest of mitigating labour losses, and could potentially bridge divides and be in the interest of the energy sector as a whole. The data will be relevant to multiple key stakeholders, including the coal mining sector, the national energy utility, ancillary industries, unions, policymakers, energy analysts, environmental NGO's and energy investors. In terms of timing, the research is being conducted during a time of crises, meaning that the direction and guidelines that it provides could inform policy development in a positive way.

This exploration of the potential of just transition approaches could identify pathways to navigate some of the perceptions within the energy sector. This exploration could also lead to further research exploring alternatives and how they relate to broader just transition framework.

From a theoretical perspective, the proposed research aligns well with the just transition concept, which is used in South Africa. The application of a just transition lens may contribute to expanding legal frameworks in the South African context.

My interest originates from my engagement with renewable energy policy and applied economics modules during my postgraduate studies in sustainable development which collectively highlighted the socio-technical and structural economic determinants of the political economy which result in widening inequality. This led to a more in-depth inquiry about research approaches that address poverty and inequality, such as just transitions and transformative justice. These broader concepts of justice have been applied to energy justice globally, and I am curious and inspired to explore their usefulness in South Africa in the interest of energy democracy.

This study aims to explore approaches to a just transition in South Africa through the application of an economic cost framework, review of global strategies as well as community observations in Emalahleni, Mpumalanga.

1.6 Limitations of the Study

The research is concerned with problems in SA's complex, plural energy sector and relies on labour data held by coal mining companies, industry associations and the national statistical services.

The coal mining sector is described as pro-fossil fuel but is increasingly vulnerable due to recent government policy uncertainty and growing divestment, both of which impacted the sector during the research period from March-September 2019. This may explain why coal mining companies supplied limited data in response to the scoping survey.

Following limited responses from coal companies, both the Minerals Council, which is the leading industry body and the former DEA were approached to try and get them to endorse the study in the hope of encouraging coal mining companies to participate. The Minerals Council did not respond at a senior level, and the DEA deflected the request to the CSIR. Subsequent engagement with a skills development manager at the Minerals Council, yielded a recommendation for the request to be redirected back to companies, citing the POPI Act.

A number of companies including Anglo Coal, BHP, Delmas and Xstrata, made limited data available. This included social and labour plans which was sourced via

the internet from official and environmental websites. However, Anglo coal removed their social and labour plans from the internet, likely due to the transfer of ownership of their coal mines to Seriti during the year.

A lack of transparency appears to be common in the sector, as is reported by the SAHRC (2018) and CER in their recent Full Disclosure Report (2019). Consequently, the scoping survey relied on data in the public domain, and in select instances, the research was extended to a broader profile of mineworkers, e.g. age breakdown of all mineworkers' vs coal mineworkers.

Another limitation of this study is its applicability to contexts outside of South Africa. The research used local data within a particular socio-economic and political context, and it cannot be assumed that it will be applicable in other contexts.

Furthermore, the study assumes that efforts will be made to identify and develop sectors that could offer re-employment in the Mpumalanga province. However, in practice, this may not translate into reality. The impact of a failure to implement regional and sectoral support will result in socio-economic instability.

For the qualitative community observations, I had to consider limitations that would result from my language, racial and social biases. Throughout a 1-day workshop, community members spoke in their home languages, and although their expressions were translated, a complete account of their reflections may have been compromised by the translation process.

The frameworks outlined in the conceptual analysis will be used to understand concepts of justice. However, while I am still learning to grasp these concepts my evolving reflections may have limitations.

The bearing of the political economy within which the energy sector is embedded (Newell 2016) is complex and requires further research. I acknowledge that this thesis was limited in this regard and that insights into relationality and materiality (Swilling 2019) affect transition courses. Although narrative discourse and interviews are suitable methods to understand political dynamics, this was considered beyond the scope of this study. I do acknowledge that it limited the research.

For this thesis, the focus is on the coal sector; a just transition applies to the energy sector, which includes utilities, ancillary sectors and the petroleum and gas industries.

These different sectors which have all have a role to play in any just transition could be drawn into the cost scoping framework in further research.

1.7 Research Methodology and Design

The research initially explored labour loss mitigation strategies through a literature analysis in response to question 1. The literature analysis is qualitative and non-empirical. In response to question 2, the research can be described as empirical and includes quantitative cost modelling. National labour data was collected, fed into a cost model and was analysed to identify supportive approaches to mitigate labour losses. These scenarios were compared to recommendations in the IRP (Integrated Resource Plan) in relation to costs and worker protection. Using protective attrition (natural retirement) rates and corresponding contraction rates, the cost of mitigating labour losses was calculated. To further validate the findings, the research included qualitative community observations in response to question 1 and 3.

The research design was a sequential combining of theory, evidence and observation. Within the field of energy transitions, scholars have broadly acknowledged the benefit of mixed methods, arguing that the range of designs offer critical perspectives as well as the tools needed to make decisions and inform policymaking processes. Researchers argue that "quantitative, qualitative and mixed methods all contribute to our understanding of the problems and the success of responses" (McCauley, Ramasar & Heffron 2019:1).

I therefore use a mixed method quantitative and qualitative approach, which is respectively associated with an objectivist and constructivist epistemology in my study.

1.7.1 Empirical Study

1.7.1.1 Quantitative Scoping Survey

The empirical, quantitative study aimed to source primary, numeric data and feed the data into a cost framework to analyse what the data reveals about the cost of a just

transition. The various components of the model were used to calculate the cost of mitigating labour losses in SA's coal sector. The data includes age ranges, salaries, the cost of retraining and relocation, pension data and community transition costs. The research made use of a structured scoping survey as per Appendix C. Findings were assessed in relation to the mitigation of labour losses in relation to different just transition strategies. This can further be quantified as rates of employment/unemployment and in relation to the ILO's definition of a decent job.

The data analysis approach is described by Mouton (2011) as follows, "descriptive and inferential statistics will be used. In the analysis of large survey data sets, typical techniques will include tabulations, correlations, regression analysis, factor analysis and make use of statistical graphics, e.g. bar charts, plots, pie charts for more visual presentation" (Mouton 2011:153).

The quantitative study will focus on organisational data and be broad (national), include multiple companies and is, therefore, comparative. The survey links to positivist meta-theory. It is inductive, yet is also theory-driven, especially concerning the literature review, which links to the quantitative labour in the analysis stage of the research.

1.7.1.2 Qualitative Community Observations

The second empirical study observes members of the coal mining community in Emalahleni. Sequentially, this qualitative research follows the literature review and scoping survey and will contribute to a greater understanding of what a just transition means to the local community. In the final stage of the research, which either refutes or confirms research question 3, the community observations will be useful in evaluating just transition approaches as they relate to specific contexts. These will also be compared to the findings of the literature review and will produce a more rounded research study.

1.7.2 Non-Empirical Study

The literature analysis will provide an overview of research related to theories and concepts of a just transition through an analysis of current research and discussions in

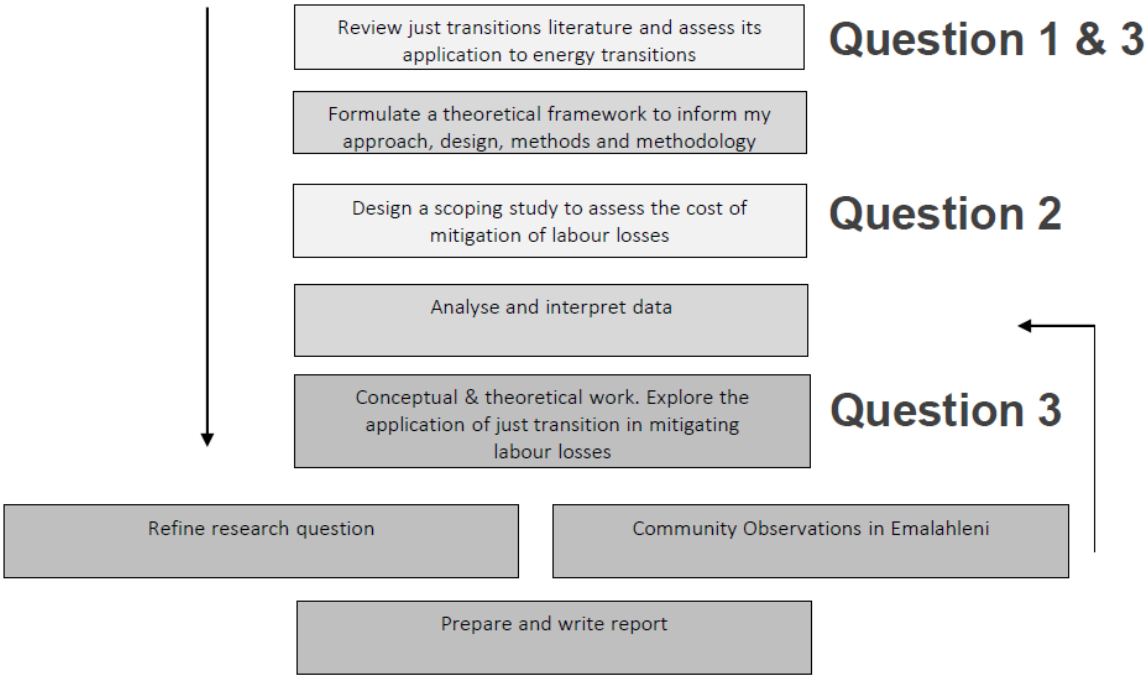
the field. The literature review will analyse textual content, narrative discourse and consist of conceptual analysis and theory construction.

Due to the complexity of the political economy, the research will apply critical thinking and will draw on theories of transitions and political theory. It will respond to conceptual and theoretical questions and be an exercise in inductive reasoning to assist with understanding the field.

The evolving body of theory of just transitions covers climate, energy and environmental disciplines and includes international and local case studies. This research focuses on the protection of coal workers' jobs, which is a labour perspective of a just transition, from within the broader field of economics or sustainability economics. While a labour perspective is being sought, literature will include climate, process-based, economic, sustainability and justice perspectives to address the broader context within which the transition is taking place.

To be able to address the research questions, the literature will be analysed methodologically, i.e. what framework/approaches did countries use and how do these compare? Finally, I will assess the impact of the approaches on the mitigation of labour loss.

Figure 1.1: Research process flow diagram



1.8 Outline of thesis

Following an introduction to the background of this thesis, the research problem, questions and rationale for the study will be defined, as well as any possible limitations. This current chapter includes an overview of the research design and methodologies.

The second chapter is the first part of a literature analysis which reviews differing concepts of a just transition, particularly concerning labour mitigation measures. It analyses energy, climate and environmental frameworks as well as dimensions of justice. It argues that more distributive and procedural rights ensue from the restorative dimension of justice. The analysis contends that the concept of a just

transition is expanding, with more emphasis now being placed on society, geography and law. This has obvious relevance to the disparate coal communities concentrated in the Nkangala and Gert Sibande municipal districts of Mpumalanga.

The second part of the literature analysis in Chapter 3 reviews methodological approaches to scoping the cost of a just transition by examining guiding principles, international strategies, supportive economic frameworks and context-based approaches. It argues that although many countries have implemented extensive just transition programmes, few have successfully mitigated job losses. It recognises that the best way to mitigate job losses is a thriving economy and that sectoral and regional development policies are effective ways to secure employment. The application of the economic cost model demonstrates how a just transition can be implemented through supportive measures and an informed approach. Finally, the review considers a framework for a context-based approach drawing on just transition literature. It identifies relevant themes, e.g. political context and policy, yet endeavours to remain true to qualitative methodologies seeking a 'sensitised' concept of a just transition that may emerge from observations to balance the quantitative economic modelling approach.

Chapter 4 outlines the methods used. These consisted of convergent, mixed methods to allow for the navigation of the complex context within which the energy sector is embedded and to account for multiple social realities. The quantitative and qualitative methods were applied to coal mining areas in South Africa and therefore allow for assumptions to be made about their applicability to the Nkangala and Gert Sibande municipal districts. Community observations and interviews with local experts reinforced the value of regional approaches and provided nuanced ideas of what a local just transition might entail.

Chapter 5 systematically presents quantitative labour data and resultant cost scenarios following Pollin & Callaci's (2019) economic just transition framework. It provides a summarised, basic cost for a just transition. It then presents qualitative, community observations according to emerging themes such as health, local-ownership, community identity and education. This exploration further prompts a deeper inquiry into the feasibility of a co-operative university in emerging RE development areas.

Chapter 6: The final chapter of my thesis provides a summary of developments in the global energy sector and South African political economy and what these mean for a just transition. It consolidates mitigating attrition scenarios and their corresponding employment contraction rates as well as a summarised cost of a just transition in South Africa. It provides an overview of key strategies including sequenced sectoral and regional policy development, co-operative vocational education, stakeholder engagement, health and pension securities.

Chapter 2: Literature Analysis Part 1: Principles of a just transition

2.1 Introduction

This chapter begins with a conceptual review of a just transition. Global research indicates that the concept has increasingly broader relevance as it becomes a means by which the threat of climate change can be mitigated. The concept is analysed as it is applied to the mitigation of job losses in the South African context.

This review argues that normative concepts, such as a just transition offer a lens with which to make sense of energy transitions from a moral perspective. It draws on frameworks from the disciplines of climate, energy and environmental justice (CEE) as well as theories of transitions.

The second part of the literature analysis reviews just transition approaches from a methodological perspective. It explores principles and frameworks outlined by the United Nations Framework Convention on Climate Change (UNFCCC) in a technical paper Just Transition of the Workforce, and the Creation of Decent Work and Quality Jobs. The principles outlined in the paper are also recommended by the International Labour Organisation (ILO), and include key concepts such as the principle of decent work and framework mitigation policies.

It analyses international practice by country, including developing countries to compare reasons, programmes, financing reviewing areas of similarity and differentiation in approach. The analysis is concerned with approaches that mitigate job losses and will highlight countries that have successfully done so.

The review also analyses successful countries in more detail and compares approaches to an economic cost model by Pollin & Callaci (2019) as an example of a ‘supportive’ approach in the interest of coal workers. Finally, the literature analysis considers a context-based approach to a just transition and compares the various recommendations.

Using the ILO/UNFCCC framework, examples of international best practice, Pollin & Callaci’s supportive cost model and a context-based approach, the research aims to sequentially evaluate appropriate strategies, assess costs and recommend relevant approaches for South Africa.

South Africa's recent low ranking in its shift to clean energy (WEF 2019) indicates the risks of an unmanaged, expensive and unjust transition. Therefore, the research results of this thesis could contribute to the development of appropriate just transition strategies that are more likely to mitigate labour losses.

2.2 Conceptual expansion: towards solidarity and measurable outcomes

To advance an effective transition to a low carbon economy, scholars have identified the need for greater collaboration to develop shared frameworks across climate, energy and environmental (CEE) disciplines. They argue that reframing a just transition, holds the potential to unite climate, energy and environmental justice disciplines (Healy & Barry 2017; McCauley & Heffron 2018).

A useful broad definition of a just transition is described by Newell & Mulvaney (2012:1) as:

> "energy access for those who do not have it; justice for those who work within and are affected by the fossil fuel economy; and attempts to manage the potential contradictions that might flow from pursuing energy and climate justice simultaneously".

This definition illustrates how it is widely applicable to climate, energy and environmental disciplines as opposed to the original approach, which was narrowly concerned with workers' livelihoods. While research scholars recommend expanding the concept through an interdisciplinary approach (McCauley & Heffron 2018), it is useful to explore some of the underlying forces that shape it.

The concept of a just transition is located in the environmental justice movement and initially responded to the trade union movement in the 1980s. More recently it has re-emerged on a global scale as part of the Paris Climate Change Agreement.

The concepts' original response on a national/country level in the US as opposed to the more recent global focus shows how the concept is dynamic and responsive.

Inherent in the interdisciplinary framing and reframing of the concept, are additional justice frameworks which get applied to the idea of a just transition (Healy & Barry 2017; McCauley & Heffron 2018). Although each of the fields of climate, energy and environmentalism have

their own justice movements, the dominant frames used by all three of these disciplines focus on (1) distributional, (2) procedural and, (3) restorative justice.

The scholars further argue that procedural justice is limited, while restorative justice must be the essential, overarching dimension for it allows for broader recourse. These principles of justice have their origins in Rawls Theory of Justice (1971), who according to Schutz and College (2007) remains the preeminent theorist on distributive justice.

Besides the conceptual expansion and applicable justice frameworks, Heffron & McCauley (2017:75) suggest that dimensions of legal geography are also having an impact. They state that "law and geography places focus on where and when the impacts of injustices occur and are major contributors to transition research". This ties in with CEE forms of justice which also focus on events in time and place.

They explain that the dimensions of geography and law highlight the place of origin of events and how these apply to outcomes, e.g. a protest leading to a policy or legal change. They further introduce the notion of a 'just societal transition' and the responsibility that rests on society to affect it. This means that communities in shared geographies e.g. Mpumalanga may have collective rights.

Expanding frameworks and interdisciplinarity can also be applied within CEE disciplines (Healy & Barry 2017). Concerning energy justice frameworks, scholars have identified emerging themes such as cosmopolitan and non-western views of justice which have started to gain more currency (McCauley, Ramasar & Heffron et al. 2018; Harris 2010 and Sovacool, Burke, Baker, Kotikalapudi & Wlokas 2017).

Non-western views of justice may have relevance in the diverse South African context, which has a history of inequality and colonialism. The National Planning Commission's Pathways for a Just Transition public dialogue series compiled a collaborative, broad view of a just transition, which represents a perspective of the global south. The following draft conceptual vision was presented at the NPC's concluding conference in May 2019.

> A just transition is one where working people, and in particular the poor and vulnerable, are protected and do not have to shoulder the burden of shifting to a low carbon, cleaner and more climate-resilient society and economy (NPC 2019).

This view purposefully recognises ‘working people, the poor and vulnerable’ and elevates their visibility. It further explicitly calls for their ‘protection’ and for the burden of a transition not to fall on them. These requirements relate directly to procedural fairness, distributional outcomes as well as restorative burden-sharing. Although this vision was developed in SA, it could be universally applied as it is not overtly non-western.

While Heffron & McCauley (2018) note that a just transition should aim to reduce inequality, the NPC vision addresses this aim through its elevation of the ‘poor and vulnerable’. Scholars further argue that concepts of justice need to relate to society, be focused on human rights and have more global scope.

The NPC concept refers to ‘society, working people and in particular the poor and vulnerable’ in broad terms, perhaps emphasising human rights as opposed to individual/civil rights. The NPC’s vision aligns to Heffron & McCauley’s argument about human rights and scope. This vision for SA’s just transition appears to align with research scholars’ recent recommendations for reframing a just transition.

However, does the NPC sufficiently recognise the needs and vulnerabilities of coal-dependent communities in Mpumalanga? Does it address gender dimensions? And, crucially does it recommend regional resilience strategies? Moreover, how does its definition relate to rising energy democracy movements? And what are its limitations?

While the boundaries and dimensions of reframed definitions of a just transition have implications for geography, human rights and society, Swilling (2019) cautions that there is a risk of making an ‘unjust transition’ if the conditions of directionality of ownership, financial flows and accountability are not in place. These principles relate directly to energy democracy and highlight how a just transition is embedded in principles that relate to access, economics and governance.

Project 90 by 2030 recognise various definitions of a just transition, including a transformative just energy transition approach:

“A transformative just energy transition aims to ensure absolute equality of energy access and complete sustainability through deep and systemic changes to holistically reimagine the fundamental reorganisation of society” Project 90 by 2030 (2019:6).

Although this conceptual analysis reviews various broad definitions of a just transition, the evocative statement by Tony Mazzocci, the labour union leader who originally coined the term 'just transition' still resonates because of its deep concern with worker's rights

"Those who work with toxic materials on a daily basis in order to provide the world with the energy and the materials it needs deserve a helping hand to make a new start in life" (Pollin & Callaci 2019:94).

2.3 Approaches to scoping the cost and mitigation of labour losses in South Africa's energy transition

2.3.1 Principles & practice of mitigating risk

Various global and local organisations provide guidelines for just transition and climate change mitigation including: the Global Just Transition Programme; the Just Transition Alliance; the United Nations Framework Convention on Climate Change (UNFCCC); the International Labour Organisation (ILO); the Trade Unions for an Energy Democracy (TUED); the International Trade Union Confederation (ITUC); the Intergovernmental Panel for Climate Change (IPCC), and the European Trade Union Confederation (ETUC).

In South Africa, just transition policy recommendations have been proposed by local stakeholders including: The National Planning Commission; the Congress of South African Trade Unions (COSATU); the Energy Research Centre (ERC), Project 90 by 2030; Meridian Economics, and Alternative Information and Development Centre (AIDC). Despite this, concrete implementation plans still need to be formulated. Local scholars and stakeholders agree that there are significant gaps in labour data needed to be able to plan for a just transition effectively.

The introduction highlighted South Africa's limited progress towards implementing a just transition. Strietska-Ilina et al. (2011) cited in UNFCCC (2016:53) suggest that: "The scale and extent of these changes depend on the speed and breadth of technological and market changes in the green transformation". It follows that policymakers must smooth the edges of this transformation by developing just transition policies.

South Africa's position suggests a more immediate implementation response is required and, therefore, it makes sense to draw on existing research, frameworks and models, which may prove beneficial to South Africa's transition. When considering an appropriate response, it is useful to review what has been implemented elsewhere, and learn lessons from these experiences.

In 2016, the UNFCCC published a Technical Report on the Just Transition of the Workforce, which examined the concept of a just transition, linkages between its impact and climate change mitigation policies, and offered step-by-step implementation guidance.

In this literature analysis, this detailed and technical report is used a reference point. It's significant to note that the UNFCCC Report contains many of the guiding principles recommended by the ILO and the Global Just Transition Framework. These will be cross-referenced against country approaches, as well as local frameworks proposed by the ERC, Project 90 by 2030, the NPC and COSATU.

The second section of the literature review will analyse Pollin & Callaci's (2019) Economic Just Transition Framework, which focuses on calculating the cost of a just transition and relates to the second research question of this study. Finally, the review explores a context-based approach and corresponding theoretical frameworks.

2.3.2 Principle of a decent job

A transition to a low carbon economy impacts employment in both positive and negative ways and has various normative 'quantitative and qualitative' impacts (UNFCCC 2016:15).

There are two specific aspects to consider regarding the impact that climate change policies have on employment. Firstly, there are the quantitative effects, which in simple terms means how many jobs are lost and gained. Secondly, there are the qualitative impacts, which refers to the quality of jobs being created or transformed (UNFCCC 2016).

In support of the 'qualitative' UNFCCC principle, various country representatives attending a Just Transition Symposium in Cape Town in 2019, repeatedly referred to the concept of 'decent' as opposed to jobs. Similarly, union representatives support the principle of 'decent' work and have been outspoken about its significance within various forums (Project 90 by 2030 2019, GroundWork 2019).

But what is meant by ‘decent’ work? Where do its parameters begin and end? The ILO defines decent work as:

> opportunities for work that are productive and deliver a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organise and participate in decisions that affect their lives and equality of opportunity and treatment for all women and men (ILO 2019).

If the concept of decent work is applied to a just transition of coal workers in South Africa, there are obviously serious implications for income, dependents, social protection, education and skills development, as well as the terms of any participatory engagement. There are also implications for the overall cost of the transition.

‘Decent’ work principles have been considered in local research which has been driven mainly by the NPC through the pathways for a Just Transition Dialogue series.

The NPC outline their broad vision for a just transition in Chapter 5 of the National Development Plan (NDP):

> providing guidance to ensure that by 2030, South Africa is an environmentally sustainable society, with an expanded low-carbon economy and reduced emissions while at the same time reducing poverty, unemployment and social inequities (NDP 2019).

Chapter 5 of the NDP provides a set of “guiding principles, which recommend that the transition be just, ethical, sustainable, transformative while taking a strategic, regional and ecosystems approach during a managed transition (NPC 2019)”. This introduces more of a sustainability focus to the concept which aligns with the ILO framework, the first part of which is outlined as follows:

> Greening of economies requires a coherent country specific mix of macroeconomic, industrial, sectoral and labour policies. The aim is to generate decent jobs along the entire supply chain with employment opportunities on a wide scale (ILO 2020).

.

However, the NPC has raised some pertinent questions during their dialogue series, including the following:

"Who pays for the input costs of the transition and how much will it cost? How is job-creation maximised and job losses addressed? How do we continue to build resilience in communities and economic sectors and ensure that the poor are not disproportionately impacted? (NPC:2)"

While these are important questions, many of them are yet to be addressed i.e. implementation plans are yet to be detailed, and engagement with key players such as unions and mining companies during the NPC Just Transition Dialogue series has been limited. These parties did not represent themselves at dialogue sessions (NPC 2019). Government is, however, said to be in the process of coordinating the development of recommendations for implementing a just transition in South Africa.

The UNFCCC (2016) acknowledges that the social aspects of the impact of climate change have not received sufficient attention, especially in regard to policy measures. Using the ILO's concept of decent work, Table 2.1 applies the underlying principles to local research findings in South Africa and considers the implications from the perspective of scoping costs:

Table 2.1 The application of the principle of decent work in SA

Application of the principle of decent work	**SA Context**
Workers will need to earn a living wage	The average monthly salary of a coal mine worker is R23 000 (Minerals Council 2018) The median salary of a coal worker is R7500 (TIPS)
A decent job would need to be at an agreed fair salary	The average salary is slightly less than e.g. non-coal miners but higher than e.g. manufacturing and construction (StatsSA).
A decent job would need to be outside of the agriculture sectors or an agreed fair salary	The average salary of a coal mine worker is significantly higher than an agricultural worker who earns R3000 (Stats SA 2019)
Workers are entitled to social protection for families	Coal workers have an average of 3 and up to 10 dependents (TIPS 2019; Kuyasa Coal 2019)
Workers deserve a qualification	83% of coal workers only have a matric qualification (Anglo SLP & Kuyasa Coal)
Education and skills development opportunities should be provided	Education infrastructure in Mpumalanga is limited to TVET colleges and 1 small, specialised university.
Community orientated programmes for social integration will need to accommodate the diverse needs of workers	The age range of coal workers is broad and spans 3 generations and their social needs may vary
The subsequent implementation plan will need to allow for multiple platforms for engagement and dialogue	The NPC have had limited engagement with coal workers and management during the Just Transition pathways dialogue series.
The transition programme needs to be designed to accommodate the needs of women	12% of the coal workforce is female (Minerals Council 2019), yet 30% of the future energy sectors workers' are female (EUSP 2019).

(Source: UNFCCC 2016 applied by author to SA)

This analysis reveals the implications of applying the principle of 'decent' work as is prescribed by the UNFCCC and ILO. For example, salaries in some sectors of the green economy may be lower than an average coal miner's salary, additional costs such as the cost of social protection for families, education, engagement platforms and transition programmes for women would need to be factored in. This analysis raises questions such as what does social protection cover, and which education options are feasible? And how does this compare with existing support provided by the Minerals Council and unions?

Although the concept of 'decent' work has been woven into the South African narrative, it is not used consistently and is therefore not a core part of the narrative. Integration into the narrative will allow for increased awareness and the prioritising of this core concept.

2.3.3 Mitigation policies and actions

The UNFCCC's (2016) policy recommendations focus on how countries could potentially approach the mitigation of labour losses.

The UNFCCC framework mitigation approach covers the following key action areas and recommends a sequential approach. In Table 2.2 below, the mitigation actions have been considered in the South African context and implications for costs have been summarised.

Table 2.2: Implication of the UNFCCC Mitigation Action approach on cost scoping in SA

Mitigation Action	Implementation in SA	Implication for scoping costs
Understanding the impacts of a climate change mitigation policy	Considered progressive in terms of commitment to the NDCs as per SA's Just Energy Transition and Sustainable Development Scorecard. Hirsch, Matthess & Fünfgelt (ed.) (2017)	The planning process is currently driven by the NPC. Strambo et al. (2019), have indicated that institutional capacity may be a challenge for the NPC/government for both the planning and implementation phases.
Research and early assessment of the impacts of a mitigation policy on the workforce	SA's transition is laggard Some research has been done, but there is a significant data gap (Steyn, Burton, Steenkamp 2018; Halsey 2018).	The scope for research is urgent and broad. But there is limited interest and support from government and industry.
Consultation and social dialogue	Limited. The NPC has consulted with communities, mainly in urban environments. (The extent of this consultation is to be determined).	The cost of consultation and social dialogue needs to be calculated and factored in.
Training and skills development	Has been prioritised in principle in NPC policy	The cost of training and skills development needs to calculated and factored in.

	statements. Has not been detailed or researched.	
Social protection and security	Has not been detailed in the NPC policy recommendations.	The cost of social protection development needs to be calculated and factored in.
Post assessment of the just transition measures and their sustainability	Has not been mentioned in NPC policy.	The cost of pre-assessment and post-assessment need to be calculated and factored in.

(Source: UNFCCC 2016)

The results from Table 2.2. deliver similar results to the analysis of the definition of 'decent work'. i.e. scoping the cost of mitigation of labour losses will need to include the cost of consultation and social dialogue, training and skills development, social protection. However, the additional costs of post-assessment (and possibly pre-assessment) need to be considered.

The UNFCCC provide a basic guideline for questions for the assessment. The Framework includes 13 key questions in their assessment of the application of a mitigation approach (Appendix A).

For South Africa, a lack of available data makes it nearly impossible to answer these questions and thus we can conclude that it is premature to assess the implementation of a just transition in South Africa according to the UNFCCC framework. South Africa remains within the pre-implementation phase.

However, from a cost scoping perspective the following are potential additional cost considerations that the UNFCCC Framework highlights:

- Collaborative development of a just transition modelling tool according to local socio-economic conditions
- Strengthening institutional capacity at local levels to drive the transition of the workforce and regional economic development plans
- Completion of Skills Assessment Study
- Involvement of the department of labour and economic planning and finance throughout the transition
- Establishment of a social protection fund
- Promotion and strengthening of access to available labour data
- Exploration of the potential for the taxation of natural resources to establish a social protection fund

2.3.4 Social Protection

In South Africa, a significant number of coal workers are contract workers. In this case, the UNFCCC suggest ad-hoc social protection. However, TIPS (2019) indicate that nine out of ten coal workers in South Africa have pensions, which is more typical of permanent workers. There's also the possibility to negotiate a 'community offer' e.g. as is done with co-operatives (UNFCCC 2016). They argue that social protection is increasingly becoming part of climate change protection measures. It does, however, take time to develop a programme as consultation is recommended throughout this process. Finally, for developing countries, the UNFCCC propose the taxation of natural resources as a means of establishing a Social Protection fund.

2.3.5 Social dialogue and consultation

Social dialogue and consultation are highlighted as crucial in the overarching model. The model emphasises the need to constantly supply up-to-date information to workers, so they are kept abreast of all developments. The UNFCCC (2016) highlight that inadequate consultation or 'not being heard' can result in social protest. The ILO provide guidelines on how to set up consultative procedures and structures, and highlight the importance of the participation of governments, workers and employers in this work at the national level (ILO, 2010b). While the UNFCCC (2016) guidelines offer technical detail, the ILO guidelines are regarded as 'best practice'.

In Germany, a work council was established as part of the consultation process which helped to facilitate the transition process. In South Africa, these collaborative structures have not yet been formally established, and key stakeholders e.g. unions have not been adequately represented in discussion forums such as the Just Transition Pathways Dialogue Series as was highlighted by Commissioner Essop at the Symposium on a Just Coal Transition for South Africa in February 2019.

Despite this, NGO's and unions have been self-organising in Mpumalanga and other provinces, largely through the Life After Coal Campaign which consists of an alliance between Earthlife, GroundWork and the Centre for Environmental Rights.

Chapter 3: Literature Analysis Part 2: Just transitions in practice

3.1 Analytical review of just transition strategies by country

Table 3.1 summarises just transitions in various countries. It focuses mainly on coal transitions, but also includes wider energy and related sector transitions that have implemented structured programmes. It outlines transition types, reasons for transitioning, programme elements, as well as a summary of how the transitions were funded and what their unique qualities were.

Table 3.1 Analysis of just transition strategies by country

Country	Key programme elements	Funding	Unique qualities
GERMANY Type: Regional Conversion Reasons: Economic, pollution, EU compliance, subsidies withdrawn	Early retirement, local employment agencies, technology transfer centres, business incubation, reorientation of ancillary industries, restoration of plants, social dialogue, multi-layered policy, vocational training society	Federal government Companies Reduction of subsidies	Zollverein UNESCO World Heritage Site Creation of a knowledge-based economy Educational institutions
AUSTRALIA Type: Local governance & national support Reasons: Economic, low carbon transition	Locally run authority, Worker transition service, Back-to-Work Scheme, Community Facility Fund, Economic Facilitation Fund, mine rehabilitation commission, incentives for companies to have a JT plan, regulation of private companies JT	Federal government: AUD43m/R435m used for: infrastructure, job creation, diversifying of the regional economy and some retraining. Victoria State: government AUD266m over 4 years/67m R670mpa. R2.6bn ZAR Total = R3bn	Local governance Collaboration with residents to "do things that matter' for the community
CANADA Type: Managed phase-out Reasons: Economic, oil & gas, pollution,	Provinces empowered to legislate, Just Transition Task Force, paid out coal power companies using carbon tax, conversion of coal-fired power stations to gas, Coal Workers Transition Fund, The Coal	Government absorbed costs. Coal Workers Transition Fund CAD40 million (income support), The Coal Community Transition Fund CAD5million for economic diversification	Politically motivated Sector conversion Collaboration & Coalitions

Climate Leadership Plan (CLP), RE, health, grassroots action	Community Transition Fund for economic diversification and development, Community focus	and development, Community Regional Economic Development Programme CAD30 million over 2 years =R1,2bn	Incentives for business
SPAIN Type: Managed phase-out Reasons: Economic, EU Compliance Economic, pollution,	Successive government policies developed with unions, early retirement (salaries 2-3 times minimum wage until retirement), compensated for voluntary termination of jobs, weak worker placement and training, funding for infrastructure and business projects, restoration of degraded areas €250m Plan del Carbon replaced subsidies with SED plan	State-funded. Training (8%), infrastructure (78%) and business projects (15%). Coal subsidies R4bn = €250m Plan del Carbon	Managed phase-out, union collaboration, early retirement
UK Type: Unsuccessful Coal Transition Reasons: EU compliance, carbon tax	Coal phase-out 2015-2025 after natural decline, Redundancy (6-12 months wages), early access to pensions, retraining (minority), (limited) regeneration jobs, reclamation colliery site, Coalfields Regeneration Trust charity, Infrastructure Investment Staffordshire sustainability village	Carbon tax, UK & EU funding, Coalfields Regeneration Trust Charity, Infrastructure investment	Carbon tax reduced coal use
POLAND Type: Economic restructuring Reasons: Free market economy	Miner's Social Package. High once-off payment (unconditional) or lower once off payment with retraining (conditional) First offer resulted in dissatisfaction and unemployment down the line. This led to bootleg mining in self-made pits (unsafe mining)	Tax Revenue & Govt.	Nuanced packages
CHINA Type: Plural/Paradoxical. Scale & Large investment Reasons: Air pollution	Provincial & City emissions targets set. (Beijing) Largest producer. Cap on consumption, ban on domestic mines. Massive investment in new coal plants. 2.3 million workers requiring re-employment. 198.6GW of capacity planned or under construction (4X the total capacity of South Africa)	30bn yuan/$4,56bn established in 2016 to assist redeploying about 1 million workers R62,6bn 1m workers (R5bn 80 000 workers)	Plural, scale

NETHERLANDS Type: Regional Conversion Reasons: Economic, natural gas discovery, oversupply of steel and coal	All workers were employed elsewhere/bridged to pension. Created high value-added sectors: health services, chemical processing, financial administration etc. Programmes to manage psychological aspects, Govt. made deals with companies	Govt. & company deals. Investment by public sector into supporting infrastructure, roads, education including university, innovation and entrepreneurship. Structural change programmes run by local authorities	Regional conversion. Govt. & business partnered. Mining companies were active players
UKRAINE Type: Sector Restructuring Reasons: Geological conditions (height). EU membership	Redundancy payments, consulting assistance, retraining, business hubs, infrastructure, special economic zones, implementing JT best practice	State-funded, however, money was misused and moved to other state budgets. Looked to international partners.	Plans to support each coal mine
INDIA Type: Towards a transition Reasons: Health (1.3m deaths p.a.) & NDC's. Coal mining is uneconomic, depleting resources. Automation.	Green jobs training, support new, localized industries, tech hubs, considering other sectors including decentralized renewables that can counterbalance a loss of jobs and industries in coal regions, Impact assessments at a regional and national level. Innovation through floating solar conversions		RE leader and innovator. Presents a positive narrative for energy transitions.
DENMARK Type: Innovative Democracy Co-operative Reasons: Innovative Democracy Co-operatives 100% RE by 2050, 40% reduction of Co2 by 2020, 50% wind power in 2020	A goal of 100% RE, 150 000 wind turbine owners, neighbours co-opted, technical infrastructure (flexible heat pumps, flexible co-generation, heat storage), intermittency infrastructure, competition, new technology at consumer level to handle fluctuations, Public regulation of fluctuation/intermittency, Links between REC consumer & supplier		Innovative, process-led
KENYA **Type:** Disciplinary neoliberalism/Plural **Reasons:** Privatisation	Global relations constituted territorial, institutional and political-economic environment	Loans secured by key development agencies and multilateral development banks.	Plural. Similar to transitions typical of the global south. Solar plus coal.
US Type: Pro Fossil Fuels Reasons: Economics, fracking	Obama initiated Power Plus Plan to aid communities. Trump derailed PPP cut funding for programmes to support communities and promote economic development in	Trump government withdrew funding for community support	Unmanaged, unjust

	regions where jobs were lost. Clean Air Act 1990. Shifted coal production from Appalachia to Powder River Basin		
BELGIUM (FLANDERS) Type: Greening existing sectors Reasons: Decoupling growth from impact	Green expertise certificates, inclusion of green skills, regional database, vertical initiatives, collaboration with universities, improved branding	Govt.-led	Focused on greening, regional development. Improving the branding/image of green careers
UK Oil & Gas Type: Workforce plan Reasons: Decline in global oil prices	Retention of sector skills, transferability of skills, finding jobs, identifying training opportunities, loans, stem related training	Govt.-led	Use of web-based tools/apps to help people find jobs
PERU Type: Plan for fishers Reasons: Contraction of fishing sector	Early retirement, financial and training support, entrepreneurial training, financed through private sector fees on vessels	Private sector fees on vessels, World Bank	a different sector, linked to changing weather patterns which may be related to climate change
EGYPT Type: Energy subsidy reforms to restore growth Reasons: Politically and economically turbulent	Increase minimum wages, fuel subsidy, Food subsidy system, free transport	All energy products (fuel, gasoline, kerosene, electricity) prices increased	Wide Govt. support
INDONESIA Type: Fossil fuel subsidy for development Reasons: Oil prices falling. Fuel subsidies benefited the wealthy and encouraged consumption. Wanted to benefit low-income groups	Transfers to regions and villages, infrastructure, and human and economic development programs, new roads, bridges, and railway tracks, as well as airports and seaports.	Fossil fuel subsidies removed	Gender focus and web-based tools are emphasised

(Source: Hvelplund 2013; Project 90 by 2030 2019; OECD 2019; Zinecker et al. 2018)

Summary of the analytical review of just transition country strategies:

The analysis in Table 3.1 shows that most countries transition for economic reasons. At the same time concerns such as pollution and health form an important part of narratives in energy transitions i.e. health is a concern for communities and will prompt them to mobilise.

In Europe, the influence of the EU has been instrumental in accelerating the transition across the continent.

In select cases, there's a strong regional focus, e.g. Germany, Australia, and the Netherlands which points to the geographic location of coal mines. These examples apply to South Africa with its concentration of mines in Mpumalanga.

The types of transitions in BRICS countries or the global south are markedly different to the global north as these transitions are plural, slow and generally consist of a combination of RE (mainly solar at scale) and a reluctance to move away from coal, e.g. in India, China and Kenya.

Countries provide varying degrees of support to mitigate job losses. This affects how transitioned are 'smoothed' and the variety of programmes implemented.

In Germany, programmes include technology transfer centres, business incubation, reorientation of ancillary industries, restoration of plants and a vocational training society. By contrast, the withdrawal of support when US President Donald Trump came to power resulted in no support being made available to coal workers and their communities.

Table 3.1 shows that many countries, mostly in the global north, have implemented just transition programmes. However, according to research not many of them have successfully mitigated job losses (OECD 2019; Project 90 by 2030 2019; Zinecker et al. 2018). High levels of unemployment, caused by a transition away from coal in particular economies, could not be mitigated by the policies and interventions put in place to address the impacts of the transition. This was experienced in the UK, China, Poland, Spain, Ukraine and the US.

The analysis of just transitions by country shows that there appears to be a correlation between early retirement of coal workers i.e. prior to retirement age of 60/65 years, unemployment and a lack of support for retraining. This usually occurs in increments of 5 years e.g. retirement at 55 or 50 years. In cases where countries retrenched workers, where they had early access to their pensions or received high once-off payments, e.g. the UK, Ukraine and Poland unemployment became a problem despite the implementation of these initiatives.

In Spain, the government's investment in infrastructure instead of re-employment programmes resulted in the inability of ex-miners to find work.

Although the Latrobe Valley Authority (LVA) did manage to mitigate job losses effectively which was indicated by positive employment effects (employment over time), there were also indications of unemployment and an inability to route workers to RE programmes. (Snell 2018).

Canada's Just Transition Task Force enjoyed a high level of support which may translate into a just transition. However, it is too early to assess at this stage.

Further evaluation of mitigation strategies has shown that bridges to pensions, i.e. early retirement, redistribution of work shifts, retraining and employment support are essential measures and were applied in Germany and Spain. In SA, the median age of coal workers is 38 and early retirement is discouraged (Strambo et al. 2019).

An important consideration is what salaried workers get paid as they bridge to retirement. In Spain, workers were paid 2-3 times the minimum wage. In South Africa, the minimum wage is low and would need to be adapted accordingly. The duration of bridging to pension is also significant because the longer the period, the higher the cost. This could be capped to manage costs, e.g. five years before retirement and an age limit could be set. For example, so, workers aged 55 and above could retire early.

Bridges to employment and the development of employment opportunities have also helped to create a steady stream of potential employment alternatives. In Germany, ex-coal workers were routed to the metals and renewables sectors, in Canada and the Netherlands they transitioned to gas. This measure highlights the value of a sectoral approach. In the case of Germany, its notable that the renewable energy sector was not ready at the time of transition and that alternative sectors, e.g. metals, had to be considered.

How do these country approaches compare to the UNFCCC mitigation policies and actions? There is a high level of awareness of climate change mitigation policies and the need for social dialogue in all countries, excluding the US where climate denialism is currently the dominant political discourse. While countries are aware of the need for social protection and retraining, their success as transition strategies are largely dependent on the levels of commitment they receive from governments. The examples of Poland, Ukraine and Spain are show how a lack of retraining resulted in unemployment.

The example of Germany remains the best mitigation model to follow. It is the only case where unemployment in the coal-mining area (the Ruhr valley) was lower than the national

average following the transition away from coal. A differentiating feature of the German transition was that it was rooted in a knowledge-based economy and integrated educational intuitions and vocational training society. Furthermore, the programme included technology transfer centres and business incubation support for workers. This programme could be replicable in South Africa as it aligns well with the countries' development agenda in areas of education/vocational training, business, technology.

However, many of the other programmes have merit the Australian case, for example, shows how the establishment of authorities such as the Latrobe Valley Authority (LVA) and the Mine Rehabilitation Commission can have a positive impact and empower communities.

Finally, the pre and post-assessment recommendations of the UNFCCC framework do feature in academic literature and industry compliance reports. The best example of this is the LVA which monitors its performance according to jobs created, community projects and families supported (Project 90 by 2030).

The just transition strategies implemented in some countries have translated into successful transitions away from coal. Successes have been achieved in Germany and Australia and Canada; Spain's transition can be considered a partial success. Transitions have been unsuccessful in the UK, Ukraine, Poland and the US, largely due to retrenchment (rather than attrition), retiring too early (more than 5 years prior to pension), a lack of support for retraining and a lack of funding for the overall programme. Many of these countries, including Germany continue to emit CO2 and while they may have implemented a transition, they are still in the process of transitioning from coal. The BRICS and global South countries are more challenging to assess as they are either not transitioning from coal at all or transitioning very slowly.

The mitigation strategies that stand out from this analysis are sectoral job opportunities, bridging to retirement, and retraining and re-employment initiatives. However, as mentioned prior, the bridging strategy needs to be carefully considered in SA due to the low median age of coal workers. Especially the impact of early retirement on pension pay-outs given that workers have dependents. More research will need to be done to determine workers' ages, profiles, pensions and the phasing of transitions from coal.

Finally, the cost of a just transition in countries where the data was made available ranges from R1,2bn in Canada, R3bn in Australia, R4bn in Spain to R62,5bn in China where 1 million workers were transitioned. Assuming similar costs in South Africa to those of China

this would mean that a just transition in South Africa would cost in the region of R5bn for 80 000 workers. These costs provide estimates which are useful for comparative purposes in this research. However, these costs could be analysed in more detail and be broken down further to have more of a sense of how to estimate costs.

Following the review of transitions by country, the dynamics of Germany's transition will be explored in greater detail in the following section with the view of working towards a model approach to cost a just transition in South Africa.

3.2 Germany's successful mitigation of labour losses

Employment in Germany's coal mining industry declined from about 753,000 in the 1950s to approximately 33,500 in 2014 – a significant decline of 96% (UNFCCC 2016). According to their report, the German economy has been historically dependent on the coal and steel industries for years which has hampered innovation and economic diversity. This encouraged the development of a small number of companies, and a concentration of supplier firms dependent on them. In the 1980s and 1990s, the Ruhr region started to unlock this stranglehold and began a process of transition shaped by local and national governments, and with worker participation.

During the transition, the average age of the German coal worker was 46 years (UNFCCC 2016). The government of North Rhine-Westphalia (NRW) developed an early retirement plan in 1972, consisting of transition payments for up to five years to bridge the time until workers became eligible for pension payments. "Efforts were made to find younger workers other jobs, with the help of personnel development centres and agencies specialising in employment promotion and training" (UNFCCC 2016:40). The Ruhr Kohled Bildungsgesellschaft (Ruhr Coal Vocational Training Society) was responsible for assessing skills and initiating retraining programmes.

A key lesson that emerges from Germany's coal transition (Galgóczi, 2014 cited in UNFCCC 2016) is that a successful transition takes time, needs a strong vision of the future and must be properly resourced. In addition, worker co-determination (as part of a cooperative tripartite structure) is an important success factor.

In Table 3.2, a comparison is made between Germany's transition plan and the 'supportive' approach outlined by Pollin & Calacci (2019). The implications for a potential framework for South Africa are also outlined.

The cost scoping approach in Chapter 5 is modelled using Pollin & Callaci's (2019) economic just transition framework and will cover some of the following aspects as captured in Table 3.2. The US model aims to support the transition of the coal sector over 20 years and to achieve an attrition rate of 83%, i.e. to protect worker income and reduce the financial liability on companies and governments. The attrition rate equals the number of workers that retire naturally as a % of the number of workers that need to exit the industry to transition to a low carbon economy over a 20 year period.

Note that some of the costs covered in the analysis of the German transition were not included in the Table 3.2, e.g. research, modelling.

Table 3.2 Comparison of just transition strategies: Germany, US model & SA

Approach to the retirement: German Coal Industry (UNFCCC 2016)	**A framework approach by Pollin & Calacci (2018)**	**A potential approach for South Africa**
Early retirement plan. Transition payment of up to 5 years	Retirement through attrition for workers aged 45-65.	Retirement through attrition for workers aged 45-65. Most workers seem to have pensions and funds are relatively healthy. (early retirement is not recommended due to low median age of SA coal workers i.e. 38 years) (Strambo et al. 2019).
Jobs for younger workers through personnel development centres and agencies specialising in employment and training	Jobs for younger workers. New job/skills for workers up to age 44	Jobs for younger workers. New job/skills for workers up to age 44 co-ordinated through local employment agency. Focus on education for employability
Technology transfer centres > new business start-ups 100 000 jobs	Technology transfer recommended.	Technology transfer centres recommended through partnerships with local institutions e.g. vocational colleges, RE local content.
Business Incubation e.g. Emscher Park International Building Exhibition. Public private partnerships. 120 projects 5000 jobs. Sustainable Industry cluster. Renewable energy jobs	Business incubation recommended	Business incubation through local SME Incubators e.g. Gert Sibande Entrepreneurship Centre. Public private partnerships. RE Jobs. (Gert Sibande 2018)

Reorientation of ancillary industry towards manufacturing RE parts e.g. wind turbine parts	Reorientation recommended	Reorientation of ancillary industries towards manufacturing/industrialisation.
Restoration of old coal plants; the use of biomass for heating	Reclamation is recommended	Rehabilitation provides opportunities for employment. Note this does take time.
Social dialogue. Only drew up compensation plans in 1993. Work compensation plans and work agreements.	Social dialogue recommended	Ongoing and crucial. Institutional capacity needs to be strengthened.

(Source: UNFCCC 2016, Pollin & Callaci (2018) and implications for South Africa by author)

3.3 Pollin & Callaci's Framework for supporting workers

The premise for Pollin & Callaci's (2019) worker support framework is that jobs are at risk in the transition to a low carbon economy, especially if there are no strong policies in place (Pollin & Callaci 2019:94). The analytical review of international just transition strategies shows that there are particular areas of weakness in labour loss mitigation policies and actions.

The authors highlight the risk of job losses and unemployment leading to instability which they argue could exacerbate climate instability. "It follows that a climate stabilisation project must unequivocally commit to providing generous transition support for workers" (Pollin & Callaci 2019:94). This argument aligns with the UNFCCC's (2016) warning about social protests in the social dialogue section on page 29.

Pollin & Callaci (2019:94) also reference Tony Mazzocci's definition of a just transition for workers, which was outlined in the conceptual analysis further emphasising the rights of workers who "deserve a helping hand to make a new start in life".

Closer examination of the last two citations above suggests a deep concern for the rights of workers, which forms the basis of their approach. The use of the words "unequivocally commit" and "generous support" illustrate this argument. It also suggests that they have a real concern for the consequences that unemployment will have in the context of climate in stability. In an unequal society, like South Africa, where distributional, procedural and

restorative tenets of justice have not been fully been applied i.e. worker communities are exposed to unsafe air, live in low-income communities and have low life expectancy, conviction is instrumental in ensuring a just transition.

This approach will determine the selection of the types of measures to be implemented. They describe their framework as basic, and suggest that the cost of a just transition will likely be 'modest' due to the likelihood of jobs in the RE sector. They raise a pertinent point concerning the potential economies have to mitigate job losses:

> the single best form of protection for displaced workers in all industries is an economy that operates at full employment. A full employment economy is one in which there is an abundance of decent jobs available for all people seeking work. In a full employment economy, the challenges faced by displaced workers—regardless of the reasons for their having become displaced—are greatly diminished simply because they should be able to find another decent job without excessive difficulties. It also follows that, in a full employment economy, the costs to taxpayers of providing reasonable levels of financial support for displaced workers would be greatly diminished. Overall then, a commitment to full employment should be understood as consistent with and supportive of the project of building a clean energy economy (Pollin & Callaci 2019:95).

This argument offers an important means of job protection. It also ties up with the previous section's conclusion that a sectoral approach is a proven way to mitigate losses. But most of all it aligns with the ILO's broad definition of a just transition, which recognises that a 'sustainable economy' is instrumental to creating decent jobs in the interest of mitigating climate change. In Germany, workers transitioned to the metals and renewables sector and in the Netherlands and Canada the designated sector was gas. If the ILO's definition applies, sustainable sectors would need to be sought and sectoral policies developed to ensure this.

Pollin & Callaci raise the issue of gender imbalances that will likely emerge as the sector transitions, which aligns with gender concerns raised by the UNFCCC (2016) and EUSP (2019) earlier. The fossil fuel industry is predominantly male, while it is estimated that up to 30% of jobs in the clean energy sector will go to women. This is a significant shift which needs to be factored in during planning stages. (UNFCCC 2016 & EUSP 2019).

The Barefoot College model below is an example of how gender imbalances can be addressed in communities. In Tanzania the college trains both young and older women as

community solar engineers enabling them to earn an income, provide access to electricity and obtain education. In Mpumalanga, the community includes informal employment e.g. grandmothers who sell food to truck drivers who transport coal. At the Just coal transition for South Africa event hosted by the ERCTIPS, IDDRI and Climate Strategies in February 2019, trade unionist Patrick Mathebane of NUM explained that "A just transition must be aligned with our culture. A system to which our people can easily adapt. An awareness of gender imbalances and the inclusive approach of the Barefoot College highlights possibilities that may be suited to the African context, namely training younger and older women to be solar engineers.

Photo 3.1 Balancing gender equality in developing countries

(Source: globalcitizen.org. Amina Shamata, a teacher at Barefoot College, Zanzibar, installs a solar light in a home in Knyasini Bondini village)

The Pollin & Callaci economic support model for a just transition can be used to calculate the cost of the following key areas to support workers in transition:

(1) income, retraining, and relocation support for workers facing retrenchments;

(2) guaranteeing the pensions for workers in the affected industries; and

(3) transition programs for fossil fuel dependent communities

They apply this model to coal mining, oil & gas extraction, petroleum refining, fossil fuel-based electricity, power generation and natural gas distribution, as well as ancillary industries

that support coal, oil and gas extraction. In this thesis, this model will be exclusively applied to the coal mining sector in SA due to scope and time constraints.

The model aims for an 83% attrition rate. As was mentioned, attrition is the percentage of workers between 45-65 nearing retirement as a percentage of the number of workers that need to be cut. In other words, the ideal is to have older workers in this age group retire naturally rather than lose their jobs.

Therefore, pensions need to be secure, and the approach recommends benchmarks for pension guarantees as well as ideal levels of pension security. Following the application of local data in Chapter 5, the implications of the attrition rate will be assessed in relation to the mitigation of labour losses and climate change as well as its relevance to South Africa.

There is a strong focus on community support, and the approach is to rely on investment into clean energy sectors to stimulate this support.

3.4 A context-based approach

In their reflections on just transitions, Swilling & Annecke (2012) highlight the importance of context-based approaches.

> We have chosen to explore the dynamics of a transition empirically in contextually specific ways rather than depict them in generic terms that could over time create a misleading impression that there is a particular transition pathway relevant for all contexts (Swilling & Annecke 2012:xvii).

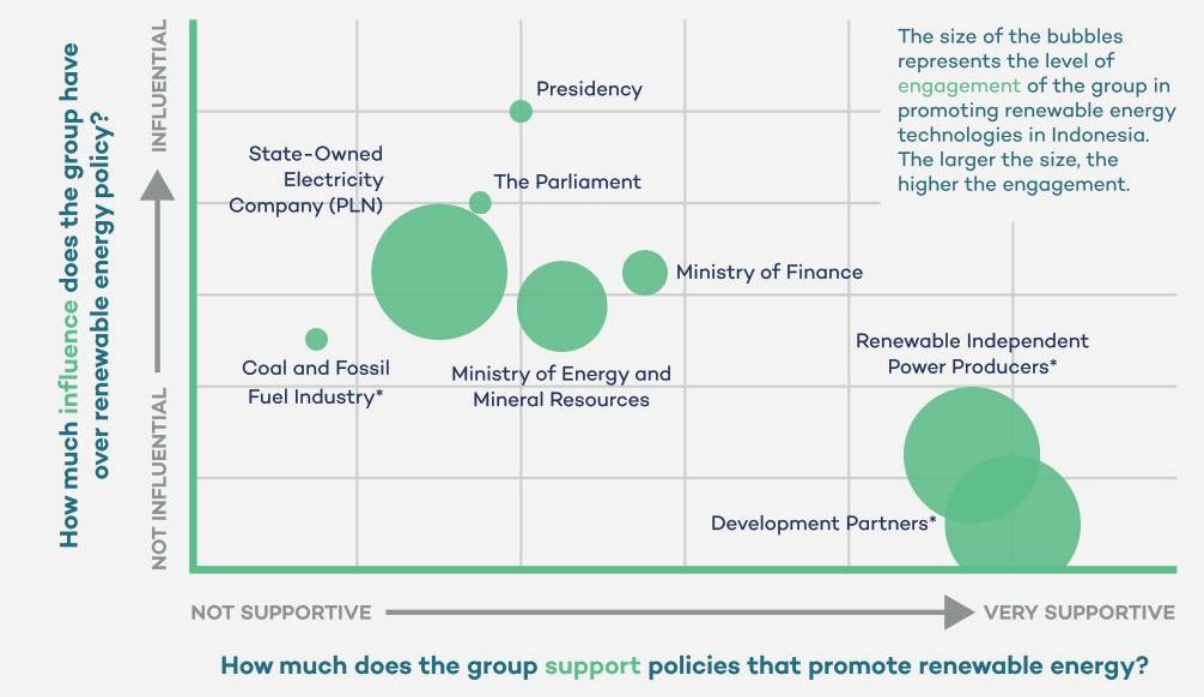
This section explores a potential framework for a context-based approach drawing on just transition literature.

3.4.1 Mapping the political economy

In their analysis of how best to understand context, Zinecker et al. (2018) focus on the need to map the political economy of each area under review. In doing so, they argue that researchers should honestly appraise both the positive and negative consequences of a transition. This process should involve as many affected groups as possible.

Newell & Phillips (2016) agree and argue that an analysis of political economy can create a better understanding. "A critical political economy analysis can enhance an understanding of this terrain by providing an account of the relations of power that characterise the relationships between exogenous forces and the state, which has to mediate, embed or challenge these forces" Newell & Phillips (2016:42). This agrees with Swilling's (2019) argument about the directionality of materiality in just transitions, and places emphasis on understanding financial stakeholders and what and their respective relationships are as a pre-requisite for policymakers to enable more of a just transition. Zinecker et al. (2018) argue that this type of analysis reveals potential allies and stakeholders and those opposing a transition to a low carbon economy. This is illustrated by the Indonesian example provided by Zinecker et al. in Figure 3.1.

Figure 3.1 Stakeholder influence map: Indonesia



(Source: Zinecker et al. 2018)

3.4.2 Socioeconomics, culture and identity

Zinecker et al. (2018) further highlight the need for an understanding of socio-economic factors, and culture and identity. They argue that "industries can shape the character of entire regions and give their inhabitants a strong sense of identity and belonging" (Zinecker et al. 2018:8, Sovacool et al. 2019). They caution that an unmanaged transition could result in a loss of culture and identity, while a positive intervention could achieve the reinvention of culture and identity.

3.4.3 Spatial divergence

As we have seen, coal mining occurs in specific areas of Mpumalanga, namely the Nkangala and Gert Sibande municipal districts. However, RE development areas are located mainly in the Northern Cape due to greater suitability of climatic conditions. This spatial divergence presents challenges of uncertainty for coal workers. (UNFCCC 2016, OECD 2019, Zinecker et al. 2018, Swilling 2019). To date, RE projects in Mpumalanga are very limited, although there are indications that the DEA's Renewable Energy Development Zone (REDZ) initiative is to be implemented in Mpumalanga (Engineering News 2019).This may result in job opportunities for coal workers.

3.4.4 Policy Integration

Burton et al. (2019:24) and Zinecker et al. (2018) argue that ambitious emission reduction targets will require an integrated approach to policy that includes climate, energy, mining and industrial policy. The analysis of country strategies for a just transition highlighted the need for sectoral policies as well as the need to bridge to sectors that will likely offer employment. It also emphasises the link between sectoral and regional approaches for the mitigation of job losses which was achieved in Germany, the Netherlands and Canada and is suitable for South Africa.

3.4.5 Labour Data

Local researchers agree there are gaps in labour data relating to income, age, skill levels and pension guarantees. It is clear that this data is needed to be able to plan for a just transition effectively. The UNFCCC (2016) argues that quality data and social dialogue is vital to assess changing labour demands. However, just transition literature indicates that it is not necessarily workers' existing sectors that matter. This is because it is the new sectors that

may offer employment that ex-coal workers will need to be trained to work in. This may require looking beyond qualifications/certificate and considering indicators of trainability.

This section has highlighted how political economy, socio-economic factors, cultural identity, spatial divergence, integrated policy approaches and labour data are necessary considerations for the South African context. The framework will be assessed against the qualitative contextual observations made in Mpumalanga.

3.5 Training & Development

Studies have shown that skills need to align with growing sectors in the interest of employment as a transition to a low carbon economy accelerates. “Country studies reveal that, while coordination between climate, environmental and skills policies can be comprehensive in some cases, it can be fragmented or practically non-existent in others” (UNFCCC 2016:53).

Energy sector skills plans need to be developed, and there’s a pressing need for research to assess worker and industry skills (EUSP 2019). Skills development efforts need to be linked to just transition policies to ensure that workers in affected regions are supported. In South Africa research is currently being done by TIPS (2019), and the national government is busy with a Sector Jobs Resilience Plan (SJRP) and National Employment Vulnerability Assessments (NEVA), and the IKI Cobenefits Study in association with the CSIR, which will provide local data.

Available studies in other countries show that workers in transition require varied skills across a broad spectrum of elementary, mid-range and advanced level. This means that substantial efforts are needed to achieve successful transformation at different levels. This research has shown that public-private partnerships were instrumental in Germany’s multi-approach transition programme. Public-private partnerships were instrumental in Germany’s transition because they implemented multiple UNFCCC mitigation actions outlined in the framework, including personnel development, technology transfer and business incubation.

The following are recent examples of South African public-private partnerships in the field of energy transitions to illustrate the range of actors participating in a local energy context.

3.5.1 South African Renewable Energy Technology Centre (SARETEC)

In November 2018 a R105m partnership between the Department of Higher Education and Training (DHET) and National Skills Fund resulted in the launch of the South African Renewable Energy Technology Centre (SARETEC) at the Cape Peninsula University of Technology (CPUT) (TVET College Times 2019). The centre offers formal training in wind and solar energy and is considering extending its reach beyond Cape Town's CBD to neighbouring area such as Bellville, and further afield via e-learning. The partnership consists of a broad network consortium including the Western Cape Government, SANEDI (South African National Energy Development Institute), Deutshe Gessellschaft für Internationale Zusammenarbeit GmbH (GIZ), Green Cape, Manufacturing, Engineering and Related Services Sector Education and Training (MERSETA) and Eskom.

3.5.2 Gwent College (Wales) and Northlink TVET College (South Africa)

In 2014, Northlink TVET College partnered with the largest vocational college in Wales through the International Skills Partnership Programme presented by the DHET, the British Council (BC), the NBI (National Business Institute) and the MERSETA (British Council 2014). The partnership facilitated a renewable energy technology learning programme focused on curriculum development and training that includes solar geyser and PV installation and maintenance and Micro/Macro RE technology awareness. Northlink described the partnerships' benefits in areas of curriculum delivery, lecturer development and workplace exposure for learners. It has specifically adapted training and development needs to the South African context. According to a British Council Report (2014), the partnership resulted in:

- Curriculum development for TVET institutions
- Support and staff training
- Identifying 6 RE employers and a survey of their needs
- Linking the programme to schools and vocational counsellors
- Links to higher education programmes

Various SETAS were involved including the Construction SETA (funding and approval of the Solar Water Heating programme), CHIETA (the Chemical Industries SETA) and an agreement was signed with ESETA (Energy SETA). These SETASs have an interest in renewable technology skills development.

Employers in both countries were involved in the partnership. A UK employer (Baxi) sponsors the Gwent Renewables Centre, and based on this experience, Northlink secured involvement from South African partners.

In both partnerships, the following main groups were included:

1. Sector Education and Training Authorities (SETAs)
2. Vocational and technology orientated higher education institutions
3. Global funders
4. Global education partners
5. Local funders
6. Local education partners, e.g. DHET
7. Business support institutions
8. Employers

Pilot public-private partnerships in South Africa indicate that they need to be well funded, rely on local and global expertise and need to comply with sector standards. Technology production, manufacturing and construction require cross-collaboration to meet industry requirements (British Council 2014).

In the Gwent Northlink collaboration, partnerships were explored with potential employers. This framework approach provides a good starting point for a collaborative partnership to facilitate skills transfer from the mining to the renewable energy sector.

The British Council (2014) research has shown that partnerships have been most effective at industry and enterprise level while they tend to be less impactful slower within government and educational institutions (universities and colleges). Therefore, driving collaborative partnerships with strong support from industry is essential.

Another alternative that has proven to be effective is partnerships that combine governmental resources with the hands-on knowledge of relevant skills of employers' associations and trade unions. For example, such tripartite structures in vocational training in Denmark and Germany have ensured that curriculums align with employer needs.

Although it's too early to measure the impact of SARETEC in South Africa, UNFCCC (2016) report that a similar training centre for renewable energy was established in Spain's province of Navarre (CENIFER), which underpinned and facilitated the rapid rise in electricity production from renewables in the region.

In summary, the research indicates that tripartite public-private structures appear to be an ideal vehicle for the management of vocational training. In South Africa, it is essential that partnerships including sector training authorities are created and are well-funded.

3.6 Transferability of skills

The IPCC recommends that countries keep global warming to well below 1.5 °C and 2.0 °C limits. In both these scenarios the renewable energy transition is projected to increase employment. In the Cobenefits Study, the IKI forecast a 17% job increase by 2050 that will translate into over 150 000 jobs in net employment terms. The challenge for skills development policy is to integrate environmental awareness with the right technical training for green jobs.

Dominish et al. (2019) review locations and types of occupations and find that jobs created in wind and solar PV alone are enough to replace the jobs lost in the fossil fuel industry across all occupation types.

In South Africa, the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) has created 32,532 direct FTE person-year jobs since 2009. It is forecast to create 109,444 direct, FTE person-years of employment in construction and operation (O&M) from all four REIPPPP bid rounds over their 20-year Power Purchase Agreement horizons (Eberhard and Naude 2017).

However, the location of most coal mine workers is in Mpumalanga, while the concentration of renewable energy plants is in the Northern, Western and Eastern Cape. Concerning the mitigation of job losses, there is potential for growth in manufacturing renewable energy technologies to offset jobs lost in the coal industry. There is also the potential for ex-coal workers to work towards manufacturing-related qualifications.

Meanwhile, the CBI (2012), cited in UNFCCC (2016), argues that skills in the United Kingdom's offshore oil and gas sector are relevant to the development of wind turbine

manufacturing. Furthermore, the skills of electrical engineers, electrical technicians, electricians and information technology specialists employed in operating fossil fuel power stations are adaptable to working renewable power plants (EC and ILO, 2011).

One possible employment alternative for displaced coal workers is in the solar industry. In the United States, Louie and Pearce (2016), cited in UNFCCC (2016), found that solar growth can, in principle, absorb all coal workers laid off during the next 15 years of transition. Their study examined occupational patterns, skill sets and salaries in both industries to determine the closest equivalent positions. They found that following retraining, technical-level workers would earn more in the solar industry than they had previously in the coal sector, but managers and executives would make less. (Pearce 2016).

Coal workers need to acquire new skills to transition smoothly ranging from short courses or at best the pursuit of a degree. To estimate potential retraining costs, Louie and Pearce (2016) examined two scenarios. At best, they suggest that workers with coal-specific positions need retraining (35 per cent of coal miners and 43 per cent of coal power plant employees). They estimate that costs range from USD 181 million to USD 649 million. Under the worst-case scenario, if all coal miners need reskilling, the cost would be USD 539 million to USD 1.9 billion needed to switch to solar-related positions and they recommend that education is funded by the industry. Finally, they highlight an important consideration that workers will need payment while in training and family roles need to be considered i.e. that workers will need payment while in training and accommodation. From a gender perspective, they recommend night classes for working moms.

3.7 Ancillary Industries

Coal mining has also created employment in formal and informal sectors. These include trucking, rail, municipalities, retail services and informal vendors and markets that sell food to truck drivers.

According to Strambo et al. (2019), trucking and rail transport of coal has shown an increase in the past ten years and services the export and local markets. As was mentioned previously, municipalities are dependent on the coal industry for revenue from services. This dependence means the impacts on suppliers and on other associated industries — such as retail and

services that depend on the earnings coal workers— could be significant, though the magnitude of these effects is not well understood. According to Strambo et al. (2019) mining companies also sometimes fund services that are typically provided by local governments, such as housing, water and sanitation via their SLPs. The provision of these services via SLPs would likely be lost after the transition.

Eskom transports coal in Mpumalanga over a road network of about 3 200 km using a fleet of more than 2 000 trucks. "The average distance travelled by these coal transportation trucks is 600 000 km/day and about 124kt of coal is moved on South Africa's roads each day through a network of 30 to 40 haulage routes. Eskom has 58 transport contracts in place with logistics companies to transport coal from mines to its power stations" (Eskom 2016).

However, increased use of road transportation to the power stations in Mpumalanga is detrimental to the environment.

Transnet Freight Rail carries coal for export and is operated by SOE Transnet which uses 1500km of heavy duty haul lines for export coal and iron ore. The coal line starts at Mpumalanga and descends from the Highveld for 580km through KwaZulu-Natal and terminates at Richard's Bay. The trains are 2,5km long and haul up to 20 800 gross tons (TFR 2016).

The Richard's Bay Coal Terminal (RBCT) is a 24 hour operation and is the single largest coal export terminal in the world, exporting more than 69Mtpa (TFR 2016).

3.8 Alternative Sectors

3.8.1 Renewable Energy

Coal mining areas in Mpumalanga have an established electricity transmission system and are close to major load centres in Gauteng province. Repurposing the region's development to be a hub for generating renewable energy is, therefore, one viable option for regional economic development that could ease the negative impacts on coal plant and mine workers.

It could also provide growth opportunities for the Mpumalanga economy more generally if coupled with the local manufacturing of renewable energy technologies and the associated value chains. "New economic opportunities need not only be in the energy industry. Evidence

demonstrates that a strategy based on multiple and diversified economic activities is more likely to succeed in cushioning the impact of the coal decline and in fostering a just transition towards new economic activities" (Campbell and Coenen 2017) cited in Strambo et al. (2019).

3.8.2 Agriculture

Agriculture and agri-processing also have potential given that Mpumalanga accounts for 46% of South Africa's high potential arable land. However, additional coal mining threatens to reduce the available area that can be devoted to agriculture (BFAP 2012, cited in Strambo et al. (2019).

Furthermore, environmental damage in the vicinity of mines will most likely make these lands unsuitable for agricultural activities. Evidence also demonstrates that rehabilitated mining land shows reduced yields (Anglo American 2016; Slater 2017) cited in Strambo et al. (2019). Another issue is that wages in the agriculture sector are far lower than those in the mining and power generation sectors. Finding credible alternatives to coal jobs requires careful consideration of wage dynamics. UNEP (2011)suggests that some of these challenges can be met by a strong commitment to farming methods with low environmental impacts (UNFCCC 2016).

Evidence from various countries strongly suggests that low-impact (organic) methods tend to be more labour-intensive than conventional farming. Farming in this way thus creates the possibility that workers could be absorbed into the agricultural sector, at least in short to medium term. Training farmers in organic agriculture methods will require resources and the existence of appropriate training courses and facilities.

As part of a global assessment, Herren et al. (2011) cited in UNFCCC (2016) ran a macroeconomic model simulating green investments in the agriculture sector. They concluded that a global transition to sustainable agriculture could create over 200 million full-time jobs across the entire food production system by 2050.

3.9 Lesson's learned from the REIPPPP and local development programmes

South Africa's REIPPPP, which was first implemented in 2011, includes socio-economic and enterprise development requirements within the bidding process.

The lessons learned from the implementation of these development initiatives provide insights for regional development and the potential for RE projects in Mpumalanga. Researchers have evaluated the REIPPPP's development programmes since it was first implemented and within the broader context of regional economic development plans in both rural and urban environments.

This section reviews research related to the REIPPPP's local economic development programmes (LED) using, where available, job creation data. The REIPPPP cannot currently be considered a vehicle for a just transition because of the way it is structured. Nonetheless, the success or otherwise of its LED programmes will be assessed in relation to the principles of a just transition as previously described.

Table 3.3 outlines the economic development and job creation criteria of REIPPPP. The table indicates a job creation target range of 12-50% on the minimum threshold and 20-80% on the maximum limit, which was raised from a target of 12-20% in the initial stages of REIPPPP (WWF 2013). Ownership ranges have remained steady at 12-30% for black ownership with community ownership targets of between 2,5-5%. While employment in coal areas is under threat in Mpumalanga, the range for South African employees appears to be acceptable. However, it may be necessary to add employment conditions which encourage gender equality and prevent women being crowded out when applying for jobs. Ideally, coal workers should have preferential access to energy jobs created in their communities

Table 3.3: Economic development criteria of the REIPPPP (Source: IPP 2018)

	Economic Development	Minimum threshold	Maximum threshold	Weighting
1	Job creation	12% - 50% (various indicators)	20% - 80% (various indicators)	25%
2	Local content	40% - 45% (differs by technology)	65%	25%
3	Ownership (Black ownership)	12% of project shareholding	30% of project shareholding	15%

	Ownership (Local community ownership)	2.5% of project shareholding	5% of project shareholding	
4	Management Control	0%	40%	5%
5	Preferential Procurement			10%
	B-BBEE Procurement	0%	60%	
	QSE & EME Procurement	0%	10%	
	Women Owned Vendor Procurement	0%	5%	
6	Enterprise Development	0%	0.6% of project revenue	5%
7	Socio-economic Development	1% of project revenue	1.5% of project revenue	15%
				100%
	Total Points			30

Assessments for suitable locations for RE in Mpumalanga are underway, and potential sites have been identified on the eastern escarpment, approximately 2 hours east of Emalahleni (Swilling 2019). This location will likely affect the displacement of workers currently concentrated in the Emalahleni/Nkangala and Gert Sibande municipal districts between 2 and 2 and a half hours away.

Local content, ED and SED will also provide development opportunities. If ex-coal miners are displaced workers to future RE areas, this will have implications for communities, access to jobs, mobility and accommodation needs.

The challenges of location, ownership and job creation highlight the need for clear governance and policy redress. They also demonstrate the scale of regional infrastructures required to manage transitions.

One of the critical challenges Davies et al. (2018) highlight is “the perception from local government that local economic development is seen as a local government function and less as a strategy grounded on principles of partnership with the private sector” (Davies et al. 2018:66).

Wlokas has drawn attention to the paucity of information about the IPP’s contributions to local economic development. This, she argues, results in a negative impact on the critical support of RE projects e.g. breakdown in communication and collaboration (Wlokas at

Windaba 2019). Both Davies et al. (2018) and Wlokas (2019) argue that the potential for collaboration between developers and local governments is undermined by a lack of information sharing between the two parties, which leads to mutual suspicion and mistrust.

Nel & Rogerson (2016), who studied the results of LED development in 278 local authorities in South Africa over the past 20 years, have described the results of this LED as 'modest'.

They attribute the lack of success to an "over-focus on pro-poor local economic development at the expense of simultaneously working with the private sector on pro-market interventions" Nel & Rogerson (2016:1).

While there's agreement between Davies et al. (2018) and Nel & Rogerson in the area of private-public partnerships, the underlying (pro-poor) approach identified by Nel & Rogerson (2016) may indicate why local government is reluctant to collaborate with private companies.

Davies et al. 2018 consider the reconfiguration of urban energy governance structures in REIPPPP and apply programme observations to devise the following framework for more of an 'experimental' approach:

1. improvement of development outcomes

2. integration of IPP's into local economies

3. building energy democracies

While the policy approaches of local government institutions appear to be outdated and researchers argue for experimental methods that allow for the integration IPP's into local economies. (Nel & Rogerson 2016) suggest that the national government already recognises the value of a pro-market approach.

Wlokas also made the following observations of REIPPPP (Windaba 2019):

- There is underexplored potential to communicate and engage better
- There is a need for the upskilling and retraining of IPP's
- There is a currently unrealised opportunity to learn from other sectors such as mining, forestry, agriculture
- The value for IPPs lies in growing their professional practice

Davies et al. (2018) and Nel & Rogerson's (2016) argument that private-public partnerships result in comprehensive and well-resourced programmes, could be applied to a just transition

for coal workers and could result in improved development outcomes for the region. Furthermore, RE programmes need to be integrated into local economic development pathways . In addition, lessons learned from the REIPPPP could benefit IPP's as potential future employers of displaced coal workers.

3.10 Summary

The literature analysis reveals that concepts of justice are expanding, and a reframed just transition may be useful, especially in countries like South Africa which have complex political economies. The analysis highlights useful procedural, distributional and restorative dimensions, as well as recent conceptual developments regarding geography, law and society.

It further discusses the importance of material flows and relationality and how they determine whether a transition will be just, positioning the relative significance of these determining factors.

The principle of a 'decent job' featured in the analysis, as it is recommended by various stakeholders in just transition literature, especially those from within the labour movement. Multiple country representatives reiterated this during A Just Coal Transition for South Africa held in Cape Town in 2019 and it is a specific focus for union representatives in South Africa.

The UNFCCC's Technical Report provides a useful framework and step-by-step plan that can be used as a point of departure to understand basic just transition approaches. The application of this framework to South Africa in the literature analysis reveals that an evaluation is premature as the process has not yet reached the implementation stage.

The framework highlights elements of a programme that will need to be included in cost calculations; however, they do not provide enough detail to show how these costs can be calculated. In addition, the UNFCCC framework shows that research is needed to plan a just transition and that social protection and social dialogue are necessary requirements of any successful transition. However, the framework seems to provide little more than a basic outline and is lacking in methodological detail.

The analytical review by country provided a more detailed analysis in a cross-sectional table. The analysis shows that many countries in the global north have implemented extensive just transition programmes. However, many of them have not successfully mitigated job losses.

The analysis revealed a correlation between (very) early retirement, a lack of support for retraining and unemployment in a number of countries. Research shows that bridges to pensions, i.e. early retirement (up to 5 years), redistribution of work shifts, retraining and employment support all have a positive impact on employment.

Bridges to employment and the development of employment opportunities helped to create a steady stream of potential employment alternatives. In Germany, former coal workers were redirected towards the metals and renewables sectors, while in Canada and the Netherlands they transitioned to the gas sector. This clearly highlights the need for sectoral policies and regional development plans.

The country analysis provided indications of costs which were in similar ranges and averaged around R4bn. This will be a useful benchmark for comparison to South African costs estimates which will be discussed in Chapters 5 and 6.

Following the country analysis, the review looks at Germany in more detail and creates a framework that compares Germany and Pollin & Callaci's (2019) just transition approaches. While the latter is a basic, supportive model, the German case provides more practical detail, both approaches have significant similarities. The only significant difference is that the German approach involves early retirement of up to 5 years while the Pollin & Callaci approach advocates for natural workplace attrition.

The review then makes recommendations for South Africa within the comparative framework, based on local contexts and opportunities. This analysis shows alignment between the approaches and a more practical and detailed approach compared to the UNFCCC framework. The latter recommends research and analysis pre & post-implementation and covers similar ground which shows a degree of alignment.

Chapter 4: Research methodology

4.1 Introduction

The political economy, within which the energy landscape is embedded (Newell 2016), is complex and plural and is represented through multiple accounts of social reality. Therefore, this thesis uses mixed methods to explore and critically analyse just transition approaches.

This research begins with a conceptual review of the boundaries and dimensions of a just transition. A review of methodological approaches to just transitions follows, with a particular interest in mitigating labour losses, as is outlined in the research question. The following literature review will define concepts, outline conceptual frameworks and methodological approaches. It draws from energy, environmental and climate justice frameworks as well as theories of justice. These are classified as middle-range theories.

The economic just transition framework by Pollin & Callaci (2019) combines theories of justice and economics and will be applied through an empirical, quantitative, cost scoping survey. Where data is limited, it will be extracted from existing sources, which is slightly removed from an empirical research study. However, it still retains an element of it and nonetheless provides relevant data for means of calculation and comparison.

Finally, the research conducts open, community observations in the Emalahleni coal mining area. Using Marshall's description of a "sensitised concept" typical of qualitative research methodology (Bryman 2014:43), these observations should result in the creation of more complete and inductive concepts of a just transition.

The literature analysis indicates that concepts of justice are expanding and now include distributional, procedural and restorative dimensions which have emerged in response to transitions more broadly. During the final analysis, these expanded theories and conceptual frameworks will be applied. The research aims to measure the usefulness of just transition approaches. The hypothesis will be further evaluated through semi-structured, qualitative interviews with key stakeholders, as well as via community observations.

4.2 Research Methods

4.2.1 Scoping Study

The study uses a model to calculate the cost of a just transition for coal workers in South Africa. This is estimated in terms of compensation, retraining, relocation and rehabilitation. Labour data was collected using a survey questionnaire and from employment data available in national databases. This data was fed into a cost model. Questionnaires were sent to coal companies to obtain specific labour data which included details of employee age, income, skills and pensions. The application of the quantitative framework is used to confirm or refute the research questions.

A supportive just transition approach underpins this study. The research uses Pollin & Callaci's (2019) economic just transition framework, which focuses on the US energy sector. This approach supports the transition of the coal sector and proposes an attrition rate of 83%, protecting workers income and reducing financial liability on companies and governments.

I requested data from companies' human resources and sustainability management departments, which was made available to me in excel spreadsheets. The survey extracted data from national data sources including Quantec and Stats SA, annual reports, industry reports, professional council and qualifications authorities' reports, SLPs, skills surveys and interviews. I captured and stored all the labour data in excel spreadsheets.

Initially, the scoping survey requested data via official company channels. The survey included a deadline with reasonable timeframes and an email follow-up schedule. To increase the likelihood of success, the research sought high-level support and buy-in.

However, finding the right contacts within companies proved challenging . Nonetheless, I identified corporate sustainability division/managers and requested the data from them. The study included semi-structured interviews which were recorded with permission.

The national cost scoping survey provides data to assist the coal sector with long-term plans to manage the transition, and to assign responsibilities and establish appropriate compensation mechanisms. This approach is designed to avoid the costs of labour reductions and sudden shocks such as large-scale retrenchments.

4.2.2 Literature Analysis

This study evaluates global and local just transition strategies through a literature analysis of academic and grey literature. In response to the 1st research question, I conducted a qualitative, literature analysis of just transition concepts and methodologies. Using an inductive approach, I evaluated the relationship between theory and the literature. The research selects recent literature, generally not older than ten years (between 2009-2019) and included research from and about developing countries where possible.

The review includes comparative studies by country conducted by labour, sustainability and climate change organisations such as the International Labour Organisation (ILO), United Nations Climate Change Committee (UNFCCC), Organisation for Economic Co-operation and Development (OECD), the International Institute for Sustainable Development (IISD) and local NGO Project 90 by 2030. While these studies provide guidelines from a range of perspectives, they remain limited as they each reflect their own paradigms and agendas.

The research compares this literature analysis to complementary observations from collaborative research workshops held in South Africa in 2019. These include:

1. The Symposium on a Just Coal Transition for South Africa by the Energy Research Centre, Cape Town on 27 February 2019.
2. Just Energy Transition Discussion by Project 90 by 2030, Cape Town on 13 June 2019.
3. Concluding Presentations from Pathways to a Just Transition by the NPC, May 2019.
4. Just energy transition: lessons learned and strategic recommendations for a positive way forward, Cape Town 19 September 2019.

In reviewing this literature, a set of specific characteristics was drawn up to enable consistent comparative analysis of each transition process. These characteristics included reasons for transition; scope of programme; financing; relevance to South Africa; key differentiators; areas of consensus, number of workers impacted, cost and limitations or shortcomings and these are reflected in a cross-cutting table.

The analysis showed that a variety of approaches were used. Therefore, the analysis further categorised each study according to type descriptors. These ranged from basic, quantitative approaches, to detailed, qualitative and technical approaches as well as principled approaches. In addition, type descriptors were created to cover practical case studies, areas of consensus and differentiation, and different methodological approaches.

I tied the research questions back to the review as a constant thread of enquiry and considered impacts of findings on costs and these were listed and analysed further. I considered the results iteratively and reflexively as the research progressed. This enabled me to integrate a critical, mixed-method approach to the literature and research more broadly.

4.3 Data gathering process

4.3.1 Cost Scoping Survey

The survey collected quantitative labour data from select coal companies using a scoping survey questionnaire. Five target organisations were identified through the former DMR (2019) which accounted for 85% of saleable coal production. These were Anglo Coal, BHP Billiton, South32, Exxaro and Sasol. A list of contacts was compiled, consisting of Human Resources (HR), Sustainability, Public Relations (PR), Risk and Marketing Managers.

Potential respondents were emailed a digital covering letter (Appendix B) which was accompanied by the questionnaire (Appendix C) and permission letter (for gatekeepers) (Appendix D). Each request was followed up by a phone call to confirm receipt. An offer was made to talk respondents through the questionnaire to clarify any questions. I kept a log-book record of the correspondence, and phone calls and email communication was tracked via respondent receipts.

Scoping survey questionnaires featured clear instructions and were presented in a vertical format for ease of use. The surveys contained about 20 open and closed questions.

Data validity was analysed for comparative purposes using industry benchmarks, labour and national statistics databases such as Stats SA and Quantec/Easydata as well as comparative analysis using Annual Reports and Coal Sector reports.

The research questions were drafted using Pollin & Callaci's (2019) Just Transition Framework. The questionnaire grouped information in data clusters relating to employee data; geographic location; pension fund data; sector data; and, sustainability and employee retraining. Each of these clusters has a bearing on the overall question of cost.

Each company had different access points/representatives responsible for their data, and it was essential to obtain the same data from each respondent.

To be able to scope the costs in a representative manner, data clusters (employee & geographical data) were treated consistently across all companies.

Sector growth and contraction rates were obtained from sector reports and standardised across the study as per Pollin & Callaci (2019). More detailed information was obtained through Mineworkers' Pension Fund Reports. Retraining costs were standardised across companies, e.g. the cost of a carpentry course for the manufacturing sector at a TVET college would be similar for employees across companies. Companies' corporate social investment contributions are often published in company annual reports; therefore, emphasis was placed on core questions during interviews to save time.

4.3.2 Literature Analysis

4.3.2.1 Conceptual Review

To attain an understanding of the evolution of the concept of a just transition, I searched for review articles. I began doing so with a broad definition of a just transition. Given South Africa's specific political and economic context, the review includes literature concerned with the global south. Review articles included justice dimensions relating to procedural, distributional and restorative forms of justice.

These concepts were explored further through Rawls Theories of Justice. The literature introduced non-western and cosmopolitan dimensions, which led to an exploration of how a just transition is evolving and being applied in South Africa. It further explores links to energy democracy. Finally, the analysis draws the review toward the narrow definition of a transition, which is relevant to the research question. The concept was applied in the South African context, including an evaluation of the NPC's vision for a just transition in South Africa and other more critical views.

4.3.2.2 Methodological Review

The methodological review was approached systematically, initially referencing the ILO, climate mitigation authorities and union federations for frameworks that outline guiding principles and framework approaches to a just transition. These guiding principles were used to do a provisional analysis of South Africa's just transition.

I then carried out an analysis by country and captured data in a spreadsheet to be able to make comparisons. The review examines leading countries such as Germany according to the principles outlined in the UNFCCC's (2016) technical report as a baseline against which to measure approaches to a just transition. Due to South Africa's lack of progress towards a just transition, data was not available for all framework categories.

The review introduces the comparative, supportive cost-based model by Pollin & Callaci, and compares it to the UNFCCC principles and the German case study. The basic framework was adapted to the cost-based model, which was more suitable for the research question.

Comparisons were made between countries that related specifically to the mitigation of labour losses, e.g. reasons for transitioning, metrics on labour losses, unemployment, review of programme success etc. Using the data by country, results were grouped between successful and unsuccessful countries, and patterns were evaluated.

4.3.3.3 Community Observations

It remains important to consider general approaches to qualitative research. Bryman et al. (2014) suggest that qualitative researchers recognise "theory as emerging out of the collection and analysis of data, rather than data as a test of theory. Qualitative data analysis involves trying to identify inherent patterns rather than imposing preconceived ideas on the data" Bryman et al. (2014:42). They suggest a departure from definitive concepts and recommend using sensitised concepts that "act as a means for uncovering the variety of forms that phenomena might assume" Bryman et al. (2014:43). This argument correlates with Swilling & Annecke's (2012) argument and will be continually considered as a context-based approach is pursued.

I was fortunate to gain access to communities members including mineworkers from Emalahleni, Middleburg and surrounding areas via GroundWork, an environmental NGO that has an active presence in the area. The observation was mostly 'open', and personal engagement was not encouraged in the public forum due to the delicate stage of the discussions (community were re-building their relationships with unions). The discussions were recorded, transcribed and coded, using Atlas.ti. As a backup, I took notes during the meeting.

4.3.3.4 Semi-structured Interviews

The research includes a series of 4 semi-structured interviews with a colliery training manager, a solar company manager/energy commodities expert, a mining company manager and a sustainability economist. These interviews were recorded, transcribed and coded in Atlas.ti. Notes were taken during the interviews as a backup. I prepared questions in advance, but most interviewees had their own agenda relating to what they wanted to discuss, except the colliery training manager who responded directly to questions. These questions served as an interview schedule. There were few non-responses. Occasionally the topic of energy transitions was sensitive, especially in the case of the mining company CEO, and these sensitive topics needed to be handled with care.

4.4 Data analysis

4.4.1 Scoping Survey Data

As mentioned in the previous section, I captured data digitally and grouped it in an excel spreadsheet to compare and consolidate findings. Various spreadsheets were created to be able to apply the data across multiple scenarios. The US application of the Pollin & Callaci (2019) framework was referenced for comparative purposes. Once the spreadsheets were created, data was placed into the main spreadsheet to calculate attrition by retirement, and coal job losses over 20 years.

The South African application uses contraction rates in line with protective attrition rates as well as decommissioning rates outlined in the IRP 2019-2030 to align the model with what is required according national plans. Job losses per annum were estimated using the various contraction rates.

The age profile, i.e. workers 45-65 and below 45, is estimated using a breakdown of ages. This data enabled the calculation of workers who will require retraining and re-employment, and those who will exit from attrition. Data from Anglo Coal's and Kuyasa Coal's SLPSs is applied to assess the differences, if any, between different size coal companies.

To assess compensation, a combination of interview data and sector reports were used to determine likely future job sectors. The costing survey obtained salary data for various sectors from Stats SA. The difference between future and current salaries was calculated and applied to various contraction scenarios between 43 and 75%.

Retraining costs were calculated using sector reports to assess what skills and qualifications are in demand for future energy and green sector jobs, and these were mapped across Energy, Water and Waste in Table 5.7. The cost of education is obtained from education suppliers, colleges and universities and is mapped in Table 5.8. These are summarised according to careers and institutions to estimate average costs. A spread of qualifications is mapped using a forecast of 70% highly skilled future workforce for workers under 45. Costs of retraining were then estimated. Definitions of skilled, semi-skilled and highly skilled workers are outlined in Annexure H.

Relocation costs were calculated using the average cost of one month's rent, moving fees and legal lease contract costs using a model from Careers24. (Careers24 2019)

Rehabilitation costs were reviewed using the CER's assessment of mining rehabilitation costs included in their report Full Disclosure research report. The costs associated with the closure of an Exxaro mine was chosen as a baseline because information was more readily available relating to this specific closure.

Secondly, Pollin & Callaci (2019) recommend coal taxation as a source of funding for rehabilitation (calculated using a formula applied to the respective prices of surface and underground coal). This coal taxation formula was applied to South Africa to estimate rehabilitation costs.

Unions, communities and regional experts identified rehabilitation as a key focus area for job creation in South Africa during community observations. Therefore, the study reviews cost estimates for US coal rehabilitation programmes and compares these to rehabilitation in South Africa. While this approach is limited and further research is required, the local data points to areas for future research. The cost of rehabilitation and funding mechanisms i.e. coal tax is considered in relation to existing taxes and obligations that companies may already have e.g. carbon tax and mining royalties. To estimate the cost of regional economic development, investments in South Africa's Social Economic Zones (SEZ's) were reviewed.

At this stage, the scoping study calculates the total costs for Compensation, Retraining, Relocation and Rehabilitation.

Finally, the research reviews Pension Guarantees. It recognises that the number of contract versus permanent staff is shifting as the market changes as former industry leaders such as BHP and Anglo divest from coal and sell their assets to smaller B-BBEE companies. Exxaro and Seriti's company profiles indicate that these changes mean that more contract workers will be employed. This shift will affect pension fund cover as contract workers may not have pensions. Socio-economic factors in the province such as poverty, and dependent numbers were considered, as well as other potential sources of income.

Pension Funds were reviewed across several companies to assess which companies invest in which particular funds. The Mineworkers Provident Fund (MPF) and Anglo Coal pensions were evaluated in most detail. To evaluate the MPF, an assessment model by economist Dick Forslund Daily Maverick (2019), at AIDC, was adopted. This model was previously applied to the Government Employee Pension Fund (GEPF). The study used the following criteria:

- Contributions Received
- Investment Income
- Benefits Paid
- Surpluses

I captured data from the MPF annual reports into excel and analysed it across eight years. I then assessed an evaluation report by an independent actuary (MPF 2018) to compare data trends and patterns.

In addition, Anglo Coal's annual report was used to evaluate information about their pension funds. The evaluation cross-referenced report data with interviews where relevant, e.g. Kuyasa Coal discussed home loans and medical cover benefits during their interview.

The research compared the MFP report to industry benchmarks which are used to evaluate coverage/liquidity and ratings. The history of pensions and governance laws were also considered in the analysis. Annual report data from the excel spreadsheet was placed into charts and bar graphs to get a better picture of patterns to be able to assess the fund's health over time. The evaluation included an assessment of income, surplus, members, benefits and retrenchments. Finally, the relevant indicators are compared to the GEPF to identify patterns.

4.4.2 Methodological just transition approaches

The literature analysis uses frameworks to assess methodological approaches, followed by a review of the mitigation of job losses. In the analysis, countries are grouped according to their success or lack thereof. These factors were then evaluated further and summarised. Successful countries were then analysed and mapped against UNFCCC and Pollin & Callaci frameworks to enable additional comparisons. At this stage, a spectrum of social protection measures emerged which are used to map measures and identify a point at which jobs are no longer mitigated. The criteria of analysis for the Pollin & Callaci model could probably be extended beyond mitigation as it is a costing model and has supportive qualitative features. The model appears to be suitable for planning for funds, especially at early stages of just transition implementation.

4.4.3 Context-based approaches

I transcribed data from interviews and community observations, which was coded and analysed according to relevant themes. The data was initially open coded, and then codes were consolidated, using Atlas.ti's Network and geomapping tools. The data is further analysed to understand relationships between various factors For example, conceptual understandings of a just transition, perceived health issues, and what effective just transition mitigation strategies are.

4.5 Summary

The use of an integrated mixed methodology in this research has delivered rich and varied data with which to make sense of a complex context at a crucial time in South Africa's energy transition.

The literature review of methodological approaches provides a clear picture of successful and relevant mitigation strategies, albeit from the global north. The country analysis provides useful technical insights about degrees of social protection which could be mapped on a comparative spectrum.

The application of Pollin & Callaci's cost model provides a detailed analysis of cost considerations. This model highlights unfamiliar areas, e.g. pension guarantees and relocation, which have not featured prominently in South African literature.

The model will likely reveal useful data about contraction rates and their relation to attrition rates and what the critical points of contraction are. Its application to different mines may reveal how the age range of workers impacts transition costs. Another significant consideration is the implication for compensation for jobs in the agriculture sector. The exercise of calculating the cost of retraining, will likely review skills levels needed for workers in the future, and the corresponding costs of retraining workers if required. The analysis of rehabilitation may raise important questions about the location of funds, how many mines are covered, and how shortfalls will be accounted for. In addition, it could raise questions about issues of transparency as it relates to rehabilitation.

The analysis may indicate timeframes for the rehabilitation programme, which could impact employment opportunities and result in the need to determine ad-hoc plans that are suitable for interim work. The review of pension guarantees will highlight the need for measures to regulate pension funds, especially in times of transition.

The context-based approach is likely to reveal a more complete picture of how communities understand a just transition.

The data obtained from the scoping study could contribute to a national, economic 'just transition' framework approach which can assist with the creation of long-term plans, better manage the transition, assign responsibilities within the sector and establish appropriate compensation mechanisms.

Chapter 5: Results

5.1 Scoping the cost of a just transition

5.1.1 Estimating job losses, retraining and re-employment

Table 5.1 outlines the effect of attrition scenarios on contraction, job losses, retraining and re-employment in South Africa. The attrition rate (Row J) equals the number of workers that retire naturally (Row E) as a percentage of the number of workers that need to exit the industry (Row C) in the transition to a low carbon economy. The original model by Pollin & Callaci (2019) aims to achieve an 83% attrition rate through retirement, i.e. a higher number of workers that retire naturally as a % of the no of workers that need to exit the industry.

Table 5.1 compares a 43% contraction scenario with ramped up scenario of 75% which reflects the decommissioning rates outlined in the IRP 2019-2030 . The application highlights the point at which an 82% attrition rate is achieved in relation to a comparative contraction scenario. As the contraction rate increases, there is a point beyond the 82% attrition rate that the number of workers needing re-employment increases more sharply.

Table 5.1 Attrition by retirement and coal job losses: SA coal workers (over 20 years)

		High Attrition *Scenario one*	IRP Decommissioning *Scenario two*
a	Contraction rate	43%	75%
b	Current employed total	82 248	82 248
c	Job losses over 20-year transition	35 367	61 686
d	Average job loss p.a.	1 769	3 085
e	Workers between 45 and 65 (35%)	28 787	28 787
f	Workers per year reaching 65	1 439	1 439
g	Workers u/45 p.a. req. re-employment	330	1 646
h	Total u/45 req. re-employment/20 yrs.	6 600	32 920
i	Re-employed workers as % of job losses	18%	54%
j	Attrition as a % of job losses	82%	46%

(Source: Employment data: Minerals Council; Age profile: Mining Qualifications Authority & TIPS)

Scenario one – achieving a high attrition rate

The application highlights the point at which an 82% attrition rate is achieved (Row J) in relation to corresponding contraction scenarios i.e. 43%. The high 82% attrition rate implies that at most 6 600 coal workers will require re-employment over 20 years, versus 32 920 in the accelerated decommissioning scenario respectively. Even at an 82% attrition rate, 6 600 translates into 330 coal workers needing retraining per year. To meet the NDC requirements, coal usage will need to reduce beyond a 43% contraction rate.

Following Pollin and Callaci, an 82% attrition rate scenario was used to calculate the costs of the just transition in South Africa which is outlined in Table 2. In effect, the model demonstrated that the ambition for an 82% attrition rate is closely in line with a least cost scenario outlined in the ERC's policy paper on Paris agreement-compatible coal transitions in South Africa. However, the picture changes radically if we take the decommissioning timeframes stipulated in the IRP seriously.

Scenario two – IRP decommissioning

The second, and most startling scenario, is that based on the contraction rate implied by the IRP's decommissioning timeframe. The IRP's decommissioning plans suggest that 75% of electricity from coal will be decommissioned by 2043. Following this plan, employment contraction rates will need to be established as part of the just transition plan. Applying Pollin & Callaci's attrition approach to this scenario in Table 5.1, 1646 workers would need to be retrained per annum (Row G) totalling 32 920 or a 46% attrition rate. This application demonstrates how the attrition approach significantly softens the blow from 61 686 to 32 920 workers thereby smoothing the impact of an accelerated scenario.

According to the Minerals Council (2019), the annual downward shifts average around 4 000 workers, and peaked at a decrease of 8 355 in 2015. This gives an idea of the increments of shifts that have been occurring historically.

Table 5.1 has shown that the duration of the transition, contraction rates and attrition targets are crucial factors to determine how many jobs will be lost. Finally, the number of workers between 45-65 also has an impact on the number of workers needing re-employment. These

key factors need to be negotiated and planned for when just transition implementation plans are proposed.

Sample data from Anglo Coal's SLP (2016) was applied using the framework to see how it applies to a large company. It should be noted that Anglo Coal SLP includes data from three mines which were sold off to Seriti in 2018. However, these coal workers are likely to continue to be employed in the sector. The data provides a sizeable sample, i.e. n=7 805.

Table 5.2: Attrition by retirement and coal job losses: Anglo Coal/Seriti mineworkers

	High Attrition *Scenario one*	Decommissioning *Scenario two*
Contraction rate over 20 years	43	75
Current employed total	7 805	7 805
Job losses over 20-year transition	3 356	5 854
Average job loss p.a.	168	293
Workers between 45 and 65 (35%)	2 732	2 732
Workers per year reaching 65	137	137
Workers u/45 p.a. req. re-employment	31	156
Workers u/45 req. re-employment over 20 yrs.	620	3 120
Attrition/Retirement as a % of job losses	82	46

(Source: Model: Pollin & Callaci 2019, SA application by author)

The scoping survey data was used to apply the model to a smaller mine, Kuyasa Coal. In this case, the figure for workers between 45 and 65 is higher at 36,6%, (based on recent data), which has a significant impact on attrition. This application indicates that the higher the percentage of workers between 45 and 65, the fewer will need alternative jobs i.e. the attrition rate increases to 84%. It also shows that in the decommissioning scenario the attrition rate is higher than the calculations for the whole sector.

Table 5.3: Attrition by retirement and coal job losses: Kuyasa Coal

	High Attrition *Scenario one*	Decommissioning *Scenario two*
Contraction rate	43	75
Current employed total	385	385
Job losses over 20-year transition	167	289
Average job loss p.a.	9	15
Workers between 45 and 65 (36.6%)	141	141
Workers per year reaching 65	7	7
Workers u/45 p.a. req. re-employment	2	8
Workers u/45 req. re-employment over 20 yrs.	40	160
Attrition/Retirement as a % of job losses	84	55

(Source: Model: Pollin & Callaci 2019, SA application by author)

Note that the data obtained from Anglo's SLP and Kuyasa will likely be applicable in the next 20 years as these mines indicate that the life of mines will extend to the next 2 decades and that "further opportunities will be explored" beyond the expected life of the mine (Anglo SLP 2019). If the workforce is likely to contract according to the above scenarios, mining companies will likely need to assess the implications for the operations of their mines. A review of the impact of retrenchments in the gold mining sector may provide some insights to the impact on operations.

5.1.2 Compensation

One of the critical principles labour leaders highlight is that all workers, and especially those in transition, deserve decent salaries (ILO 2019, Mazzocchi 1993). In this section, the Pollin & Callaci (2019) model proposes compensation for differences between current salaries and the gap between future salaries in sectors with potential for job creation, e.g. green or mixed green economies where salaries may be lower.

Research is currently being undertaken to assess which sectors may offer alternatives for coal workers in Mpumalanga and this research includes the renewable energy, agriculture, tourism and metal sectors (TIPS 2019). The compensation estimate compares salaries in possible future 'green' sectors to the average coal workers' salary in Table 5.4. Research suggests that renewable energy jobs will increase in the following sectors: construction, manufacturing and services sectors, in the operation and maintenance of solar power generation, and in transportation, warehousing, utilities, agriculture, education and healthcare, information, sales

and mining and extraction (IKP 2019). Many of these apply to the renewable energy sector and will likely be applicable to South Africa if renewable energy projects will be implemented near the affected coal towns in Mpumalanga.

While it's not a given, that jobs will automatically be available in the towns associated with coal mines, the availability will have a significant impact on the cost of compensation.

Table 5.4: Average salaries per month Stats SA 2018

Green/Mixed Economy Jobs	Monthly Salary
Agriculture	3 169
Education	15 600
Construction	16 528
Manufacturing	18 510
Transportation and warehousing	24 770
Mining	25 510
Tourism	26 062
Services	26 062
Electricity, water & gas	44 228
Coal	23 000

(Source: Table 5.4: Stats SA 2018, Education salaries by Businesstech 2019)

The Minerals Council report that the average salary for coal workers is just under R23 000. The scoping survey found that Kuyasa Coal's average is R23 422. Based on the Table 5.4 above, it is clear that some careers would offer wage increases, while others offer significant decreases.

This research calculates the cost of compensation as follows:

The difference between coal salaries and the average salary of the mixed green economy X 12 months X the number of workers requiring retraining/re-employment X by 5 years.

R23 000-R20 000 = R3 000 X 12 = R36 000 X 330 X 5 years = R60m

R23 000-R20 000 = R3 000 X 12 = R36 000 X 6600 X 5 years = R1.2bn

Mixed green economy jobs are defined as a combination of non-coal jobs and green economy jobs.

Note that the figures for the Electricity, water & gas sector were not included in the calculation of the average salary of mixed green economy workers that data is likely to artificially inflate averages, and the coal sector should be excluded from the future mixed green economy.

The number of employees that need to be covered equals 330 at the 82% attrition rate scenario as per Figure 5.2. A high attrition rate is recommended for South Africa due to socio-economic circumstances of coal workers in SA. This means that 330 workers will need to be re-absorbed into the Mpumalanga mixed/green economy per year as the coal sector contracts.

The corresponding compensation costs are indicated in Table 5.5 for the attrition rate of 82%. If the contraction rate increased to 75% the compensation insurance will increase as indicated.

Table 5.5 Compensation costs excluding agriculture sector

Contraction Rate	**43**	**75**
Total No. of workers requiring reemployment	6 600	32 920
Compensation total @ R3 000 X 12 X 6600/32 920 X 5 yrs	1 200 000 000	5 925 600 000
Attrition Rate	82	46

(Source: Model: Pollin & Callaci 2019, SA application by author)

The government recognises the agricultural sector as vital for future employment (National Treasury 2019). Therefore, further analysis was done on the agriculture salary gap and compensation for workers in Table 5.6 below. This research shows that the cost of compensation is significantly affected by how many workers enter this sector. These costs will depend on development in the region and the type of agriculture, e.g. monoculture vs agroecology.

Table 5.6 Compensation costs including the agriculture sector

Contraction Rate	**43**	**75**
Total No. of workers pa requiring reemployment	6 600	32 920
Compensation pa @ R20 000 X 12 X 6600/32 920 X 5	7 920 000 000	39 504 0000 000
Attrition rate	82	46

(Source: Model: Pollin & Callaci 2019, SA application by author)

The calculation of compensation for various scenarios highlights the increased costs in accelerated scenarios, as well as the implications for sectors where wages are well below average e.g. agriculture. Compensation needs to be considered in relation to these costs and factored in accordingly. Similarly, there is also a cost of not transitioning and these need to be considered as well. The concept of compensation aligns with the ideal of providing decent jobs, especially in a sector where these norms have already been established. However, Agriculture could be seen as a short term prospect as it would not be seen as a decent job without the compensation, unless the wage gap could somehow be addressed.

5.1.3 Retraining

While further research is underway to pinpoint future job prospects (TIPS 2019), there is some data available on coal worker's skills levels and the average cost of qualifications, including those relating to green and energy sector skills. There has been an increase in the literature on the transferability of skills, (Dominish et al. 2019; IKI 2019) which helps to inform transition management processes. These data sets will be used to calculate the cost of retraining workers below 45 using Pollin & Callaci's (2019) model.

International Climate Institute (IKI 2019) estimate that 1,6m new power sector jobs will be created across the broader economy in the transition to the low carbon economy up to 2050. They forecast that most jobs will be in construction, manufacturing, services sectors, in the operation and maintenance of solar power generation, transportation, agriculture, and mining. They suggest that 70 % of renewable power generation jobs will be created in the highly skilled group i.e. these employees will have an undergrad or postgrad qualification.

Interviews conducted with various energy sector specialists in Mpumalanga highlighted the risk of pursuing renewable energy jobs as the main or only alternative to coal sector jobs (Montpassen-Clair, Levington & GroundWork 2019). This is because the current penetration of renewable energy in the province has been negligible (Levington 2019). However, following the 2019 Windaba conference, it was confirmed that the Renewable Energy Development (REDZ) programme will include Mpumalanga (Engineering News 2019). Local expert recommend that further research is necessary but indicated that regional development, mixed green economies and rehabilitation are possible alternatives that may be more suited to the coal mining region and community.

Research conducted in the UK suggests that future energy technologies include smart grids, power storage, electric vehicles, new power generating technologies, robotics and automation, micro-grids and third-generation biofuels (Energy Utilities Skills Partnership 2019). This research argues that new, high-level skills will be needed to manage the installation and operation of these new technologies (EUSP 2019:76). Table 5.7 outlines future skill needs across the Energy, Waste and Water sectors.

Table 5.7 Future skills breakdown in energy, water and waste sectors.

Energy	**Waste**	**Water**
High-level science, physics, geography and hydraulics, engineering skills, customer service and stakeholder engagement, data analytics, telecommunications, digitisation, marketing and communications, business and commercial, project and programme management	High-level engineering, chemical, biological, business and commercial, regulatory testing, sampling and analysis skills, customer service and stakeholder engagement	High-level science, particularly chemistry, biology, geography and hydraulics, engineering skills, customer service and stakeholder engagement, data analytics linked to business performance, telecommunications, business and commercial skills.

(Source: UK Energy Utilities Skills Partnership 2019)

The SA Energy & Water Sector Education Authority (EWSETA) Strategic Plan outlines Skills Gaps, Pivotal Skills and Hard-to-Fill Vacancies (HTFV's). For example, HTFV's include the following careers: Water Quality Analyst, Boiler or Engine, Operator, Environmental Scientist, Engineering Manager, Civil Engineering, Technologist, Civil Engineer, Environmental Engineer, Program or Project Administrator, Mechanical Engineering Technologist, and Water Plant Operator. This highlights the need for

Engineering or Science Technology Engineering and Maths (STEM) skills as well as the need for the EWSETA to drive skills that are needed in the sustainability economy.

While the adoption of new energy technologies may appear somewhat distant at present, the integration of skills development measures into regional, sectoral, educational and national policies needs to commence timeously to be able to meet the skills development and job needs of Mpumalanga's youth.

This research considers growing sectors of the South African economy, skills required for the growing RE sector and for select energy and green economy jobs as a basis with which to calculate the retraining needs of younger workers using the Pollin & Callaci (2019) model. The application will not include all jobs, rather a selection to estimate average costs as outlined in Table 5.8.

Table 5.8: Education costs: institution, qualification and duration

Qualification	Institution & Location	Duration	Cost
ARTISANAL			
Trade Qualification e.g. (Hydraulics, Plater/Welder)	Colliery Training Centre, Mpumalanga (CTC)	2.5 years	R80 000
RENEWABLE ENERGY			
Smart Grid Systems Course	SAIEE Edenvale, Johannesburg	2 days	R16 000
Sunrise Intermediate Off Grid Course	Maxx Solar Academy, JHB	2 days	R3 850
Super Solar School	Maxx Solar Academy, JHB	5 days	R12 500
PV Green Card Installer	Maxx Solar Academy, JHB	2 days	R5 900
Solar Power Designer Grid Tied	Maxx Solar Academy, JHB	2 days	R5 500
Solar Power Designer Off Grid	Maxx Solar Academy, JHB	2 days	R6 600
Solar Power Designer Commercial	Maxx Solar Academy, JHB	2 days	R7 200
PV Mounter	Maxx Solar Academy, JHB	2 days	R4 900
PV* Sol Premium 3D PV System Sizing & quotes	Maxx Solar Academy, JHB	1 day	R2 800
Maxx Train the Trainer	Maxx Solar Academy, JHB	not available	R10 000
Wind Turbine Technician	SARETEC Bellville, Western Cape	1 week	R18 000
DGS Solar PV Course	SARETEC Bellville, Western Cape	1 week	R11 495

PV Green Card Assessment	SARETEC Bellville, Western Cape	2 days	R3 450
GWO Basic Safety Training	SARETEC Bellville, Western Cape * Also offered at CTC in Mpumalanga	2 days	R16 000
TVET National Curriculum Vocational			
Civil Engineering and Building Construction	Nkangala TVET College, Middleburg, Mpumalanga	3 years	R 13 730.80pa
Electrical Infrastructure Construction	Nkangala TVET College, Middleburg, Mpumalanga	3 years	R 13 551.00pa
Engineering and Related Design	Nkangala TVET College, Middleburg, Mpumalanga	3 years	R 17 639.40pa
Finance, Economics and Accounting	Nkangala TVET College, Middleburg, Mpumalanga	3 years	R 9 833.20pa
Hospitality	Nkangala TVET College, Middleburg, Mpumalanga	3 years	R 16 656.40pa
IT & Computer Science	Nkangala TVET College, Middleburg, Mpumalanga	3 years	R 13 457.80pa
Education & Development	Nkangala TVET College, Middleburg, Mpumalanga	3 years	R 9 541.20pa
Tourism	Nkangala TVET College, Middleburg, Mpumalanga	3 years	R12 786.80pa
Engineering Studies Mechanical, Chemical & Electrical	Nkangala TVET College, Middleburg, Mpumalanga	3 years	R1 803.47 (N1-3) R2103.93 (N4-6)
TVET National Accredited Technical Education Diploma			
Business Management	Nkangala TVET College, Middleburg, Mpumalanga	3-year diploma	R9 098/semester R18 196 =R54 588
Engineering (Civil, Mechanical & Electrical)	Nkangala TVET College, Middleburg, Mpumalanga	3-year diploma	R6 065/trimester R18 195 =R54 585
TVET ARTISAN			
Plumbing	Nkangala TVET College, Middleburg, Mpumalanga	1 year	R15 000
Carpentry	Nkangala TVET College, Middleburg, Mpumalanga	1 year	R15 000
Bricklaying	Nkangala TVET College, Middleburg, Mpumalanga	1 year	R15 000
Welding	Nkangala TVET College, Middleburg, Mpumalanga	1 year	R15 000
Electrical	Nkangala TVET College, Middleburg, Mpumalanga	1 year	R15 000
UNIVERSITY			
B. Com Degree	University of Johannesburg/UJ, JHB	3 years	R32 560pa R97 680
B.Sc. Degree	University of Johannesburg/UJ, JHB	3 years	R50 020pa R150 000
B. Eng Degree	University of Johannesburg/UJ, JHB	3 years	R47 330pa R142 000
OTHER			
Data Analytics	Explore Datascience Academy The Knowledge Academy Getsmarter UCT	1 year 1 day 8 weeks	Sponsored R28 365 R14 500
Customer Services	INTEC	12 months	R5 300
Agriculture	Mombela University	3 year	R74 256

(Source: CTC, SAIEE, Maxx Solar Academy, SARETEC, BusinessTech, Nkangala TVET College 2019)

From the full list above a selection was made to include career-directed courses per institution to reflect varying summarised costs.

Table 5.9 Summarised costs of education, institution and duration

Qualification	Institution & Location	Duration	Cost
Trade Qualification e.g. (Hydraulics, Plater/Welder)	Colliery Training Centre, Mpumalanga (CTC)	2.5 years	R80 000
Solar & Wind Turbine Technician	Maxx Solar Academy, JHB, SARETEC Bellville, Western Cape	1 week	R15 000-R20 000
Engineering and Related Design, Civil Engineering and Building Construction, Tourism	Nkangala TVET College, Middleburg, Mpumalanga	3 years	R40 000-60 000
B. Com, B. Sc. & B.Eng Degree	University of Johannesburg/UJ, JHB	3 years	R100 000 - R150000

(Source: CTC, Maxx Solar Academy, SARETEC, BusinessTech, Nkangala TVET College 2019)

As we have seen, it is forecast that 70 % of renewable power generation jobs will be created in the high skilled group, i.e. employees will have a degree (IKE 2019). When applying the principles of a just transition, it is necessary to retrain workers so they can find work outside of the coal sector. High skilled workers are needed in the future, therefore, retraining needs to reflect this reality. Table 5.10 up-weights retraining costs towards degrees. Note that 17% of employees from within the coal sector already have degrees.

Table 5.10 Retraining costs

Total workers	Workers pa	%	Type of Course	Cost	Total Cost
1056	53	16	Already have degrees. Retraining/Top-up: e.g. Hydraulics, Geography	R40 000	R43m
3 564	178	54	Degree	R140 000	499m
1 320	66	20	Vocational	R50 000	66m
660	33	10	Solar/Wind Turbine Technician	R20 000	13m
6 600	330	100			R621m/31m pa

(Source: Compiled by author 2019)

Although the results include local colleges, the logistics of retraining workers needs to be considered carefully. i.e. will they be in employment while studying enabling them to continue to earn a salary? What about the cost of relocation in the case where workers will need to study full time in Johannesburg? Will accommodation, food and transport allowances apply? These potential variables have been excluded in this calculation.

Finally, an opportunity exists to create local education institutions, ideally harnessing existing infrastructure (CTC, TVET colleges, OR Tambo Maths and Science College) where possible. Existing colleges may need to upgrade their facilities to be able to offer communities the types of skills needed in the future . There is also room for community colleges to address community needs for improved foundation skills or for Adult Basic Education and Training (ABET).

Furthermore, there innovators in the vocational education sector (in urban centres e.g. Northlink College) who have piloted partnership programmes. Gert Sibande college has an established entrepreneurship and eLearning centre.

5.1.4 Relocation costs

It is likely that workers who have families in Mpumalanga will prefer to stay in the region. Therefore, not all 360 workers will need relocation allowances. In South Africa relocation allowances usually cover one month's rental, transport for moving possessions costs and in some cases legal contract costs for new leases (Careers24 2019).

Relocation, that is support provided to workers displaced from the shutting down of the facilities where they are employed, comes to R100m. Relocation costs were based on one month's rent, travel costs and sundries like legal costs for a lease averaged at R15 000 X 6 600. Not all workers will need to relocate which will accommodate variances in the average cost.

5.1.5 Rehabilitation and Regional Development

Rehabilitation and regional development are areas of interest, especially amongst coal mining communities, unions, environmental organisations and researchers. The processes of reclamation and development have the potential to involve affected communities, improve livelihoods and create jobs. However, South Africa's history of spatial segregation, uneven

access to land as well as the neglect of mining rehabilitation is an important consideration when planning to rehabilitate and develop mining areas (SAHRC 2018).

According to the Centre for Environmental Rights (CER), mining companies are obliged to set aside funds for rehabilitation ahead of mine closures and these funds are meant to be ring-fenced so that the state can access the funds should companies renege on their responsibilities (CER 2019).

The CER analysed the rehabilitation budgets of 11 mining companies in a report titled *Full Disclosure: The truth about mining rehabilitation in South Africa* in 2019 and found a lack of transparency and non-adherence to relevant law and accounting standards. Their report noted "The information … is inconsistent, unclear, in some cases unreliable, and not comparable between companies. It is, therefore, impossible for shareholders or taxpayers to hold companies or regulators to account" (CER 2019). This highlights the challenge of determining where funds are located, how much is available and if companies will meet their responsibilities.

Effective rehabilitation requires an appreciation of the spatiality (location, resources e.g. water and land, public spaces) of affected areas. Figure 5.1 indicates mining areas while Table 5.11 indicates the number of workers in each area as well, as well as corresponding districts. The majority of mineworkers in Mpumalanga are concentrated in the Nkangala (74%) and Gert Sibande (32%) municipal districts in the towns of Emalahleni (52%), Steve Tshwete (19%) Govan Mbeki (16%) and Musukaligwa (8%) (TIPS 2019).

Figure 5.1 Mineworkers' location by municipal area (TIPS 2019)

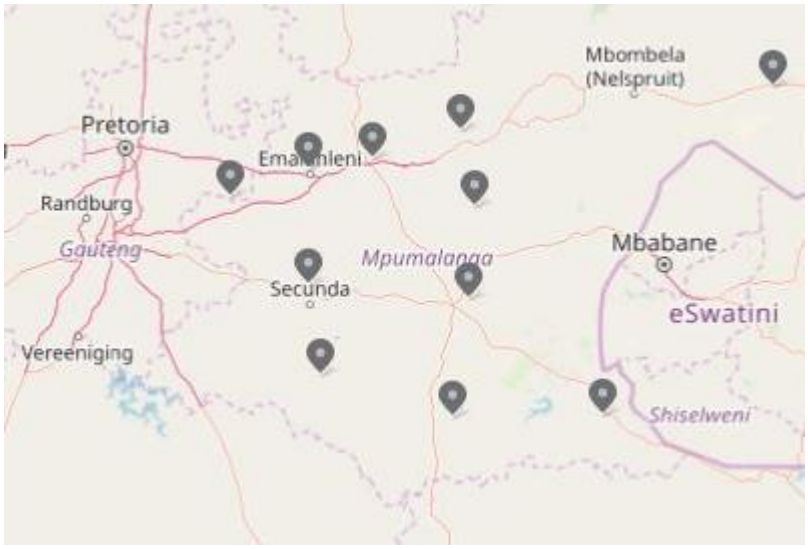


Table 5.11: Mineworkers' location by municipal area (TIPS 2019)

Location by Municipal Area	
Nkangala	49 162
Emalahleni	34 342
Steve Tshwete	12 542
Victor Khanye	1 797
Emakhazeni	481
Gert Sibande	20 804
Govan Mbeki	10 470
Musukaligwa	5 229
Lekwa	1 898
Mkhondo	1 872
Albert Lithuli	1 266
Pixley Ka Sene	69
Ehlanzeni	398
Nkomazi	398
Mpumalanga	66 075

These municipalities and communities have become reliant on the income and support services derived from coal mining, and these dependencies must be considered when managing a just transition in these areas. Therefore, mine closures, rehabilitation and regional development needs to be managed sensitively to accommodate the communities' needs. But how could the cost be managed?

Pollin & Callaci (2019) recommend that the cost of rehabilitation, could be funded through coal taxation "as a percentage of the market prices for coal," as is done in the US through the Abandoned Mine Land (AML) program initiated in 1977. Although this US fund has contributed to significant rehabilitation, shortfalls still exist. Fee rates were initially calculated at 1,6% of the average price of a ton of surface coal and 0,7% of underground coal.

However, Pollin & Callaci caution that market prices may fluctuate meaning that fees collected can fall. Coal tax in the US, despite generating $9billion, fees have halved since the program was introduced. South Africa's domestic and export coal sales have declined in volume by 8% since the 2008 to 2012 period. Despite this, the Minerals Council reported total coal sales in volume of R146bn in 2018, up from R130bn in 2017. Using the Pollin & Callaci percentages above, the annual revenue from a coal tax in South Africa is calculated at R1,7bn below to demonstrate what the revenue would be using this approach:

Share of Volume X Total Sales X Percentage for Surface vs Underground Coal

47 % X R146bn X 0,7% = 480m

53 % X R146bn X 1,6% = 1,2bn

=R1,7bn

In South Africa, companies already pay mineral royalties to landowners or communities that live on the land and this is regulated by the Mineral and Petroleum Resources Development Act (MPRDA), and these royalties are not evenly distributed and opened to abuse (Corruption Watch 2018). Coal tax, if feasible for SA would be applied in addition to mineral royalties, rehabilitation funds and company tax and would also need to be considered in relation to carbon tax so that the collective tax burden on businesses is not prohibitive. Therefore, the feasibility of coal tax will need to be assessed further before it is recommended in SA.

Following closures and the completion of the rehabilitation process, further reclamation and local economic development can take place. However, research has indicated that rehabilitation does take time (Pollin & Callaci 2019) and regional economic development to meet more immediate employment needs will also require extensive support from national

and regional government and the private sector. Therefore, regional development plans need to commence as soon as possible.

In the US, Pollin & Callaci (2019) reference the $200m Worker and Community Transition Programme (WCT), which was implemented by the US DOE between 1994-2004. Thirteen communities located in rural areas which were reliant on coal, participated in the program which consisted of grants for diversification, voluntary separation, assistance for job seekers and basic benefits. According to Pollin & Callaci actual reclamation and repurposing was limited and tended to be somewhat short term. They compare the WCT programme with a nuclear decontamination programme in Piketown which cost between $300-400m, as well as a Defence Reinvestment Conversion initiative which cost $4bn pa.

To estimate rehabilitation and regional development for a coal transition using local data is challenging because this has not yet been done before in South Africa. The closest regional development initiatives by comparison are Special Economic Zones (SEZ's) that have received the following investments from government: Coega R3,2bn: East London IDZ R4,4bn:Saldanha Bay R3bn, Tshwane Automotive and Dube R40bn (fin24.com, DTI, Business Day, IOL 2019). The magnitude of these investments align with that of the WCT programme.

In terms of rehabilitation costs, the CER's reports that the costs of rehabilitating Exxaro's mines is R3,7bn. The company is said to have set aside funds for 38% of the cost and reports that they will be able to meet 82,5% of the costs overall (CER 2019).

In conclusion, the estimated contribution of government to regional development in SEZ's can be estimated at around 4bn. For rehabilitation, companies are legally required to rehabilitate mining areas and that the interviews and community observations revealed that funds have been set aside. More research needs to be done to see where these funds are and how they can be accessed by communities.

5.1.6 Summary of Costs

Table 5.12 Summary of the cost of a just transition for coal workers in SA over 20 years

Costs	High attrition Scenario (Total)	High attrition pa	Decommission Scenario (Total)	Decommission Scenario pa
Compensation	1 200 000 000	60 000 000	6 000 000 000	300 000 000
Retraining	621 000 000	31 050 000	3 200 000 000	160 000 000
Relocation	100 000 000	5 000 000	500 000 000	25 000 000
LED	4 000 000 000	200 000 000	6 000 000 000	300 000 000
	5 921 000 000/6bn	296 050 000/300m	15 700 000 000/16bn	785 000 000

(Source: Author's application)

This first attempt at estimating the cost of the just transition for coal workers naturally does not account for all aspects of what these efforts will entail in reality, and indeed, the dynamics that they will trigger. Specifically, the cost model does not account for full-programme costs such as pre and post assessment, just transition 'model' development, establishing and managing a just transition commission, travel, accommodation and stipends for workers being retrained, strengthening social institutions (CBO's and legal support networks), health compensation costs, community and family employment initiatives, to mention a few. For this reason, the model and its resultant cost estimate must be positioned as a low-end rough estimate.

It is imperative that compensation, retraining, relocation, rehabilitation and pension security costs are adequately planned for in South Africa's strategic just transition plans.

What this research does, for the first time in South Africa, is to shed light on the extent of the costs involved with realising a just transition for the coal sector. Communicating this first attempt to estimate the cost of the just transition, this R 6 billion figure could prove instrumental in shaping the strategies employed to transform our economy. With increased support, this model has the potential to be deepened with more accurate figures and extended across the energy sector at large. This hinges on the participation of the mining sector in releasing accurate information about employment and rehabilitation.

But who pays?

Globally, the cost of a just transition is administered through innovative institutional and financial arrangements facilitated by national government. In some cases, a just transition commission has been constituted to administer climate and development finance, underpinned by inclusive strategic planning. High-level buy-in and leadership, from government is essential to unlock sufficient resources, provide appropriate incentives and enforce punitive measures to advance the energy transition.

The first step in finalising a just transition plan

If the decommissioning timeframes stipulated by the IRP are taken seriously, South Africa's coal sector will need to contract by two thirds. To mitigate the impact, three things must happen in tandem. Firstly, the decommissioning rate must be correlated as far as possible with the best possible attrition rate. Secondly, the investment in retraining must correlate with investments in new renewable energy infrastructures and value chains that have proven to be labour intensive. Thirdly, as indicated by the President in his statement to the UN Summit, a Just Transition fund must be established to fund the just transition. This will require a minimum of R6 billion for the bare essentials, but this will vary depending on decommissioning and attrition rates.

This research provides a first effort in this direction. No matter which way you look at it, a just transition in South Africa is going to be a costly affair. But, as the saying goes, there are no jobs on a dead planet. If our lowest cost energy future depends on the finalisation of a just transition plan, the costing exercise initiated in this research could not come at a more urgent juncture in South Africa's future.

Table 5.12 estimates the total and annualised cost of a basic just transition for coal workers over 20 years. It is a rough calculation using available national data. The total cost is within the range of just transitions in other countries which are between R1,2bn to R5bn (GSI 2018; Project 90 by 2030 2019 & OECD 2019). Note that inflation will need to be factored in when building on this data for more accurate estimates over the period.

5.1.7 Review of Pension Guarantees Summary of Costs

The Pollin & Callaci (2019) economic just transition framework is based on achieving attrition through retirement, which largely depends on pensions being secure, decent and available. According to TIPS (2019), 90% of South African coal workers contribute to a pension fund. This percentage does not, however, account for contractors.

While a significant number of coal workers have historically held permanent positions, recent divestment in the coal sector has paved the way for the emergence of new market leaders, who employ a significant proportion of contract workers.

Until recently, Anglo Coal and South 32 held dominant positions in the market. However, the recent sale of assets and announcement of divestment, have effectively restructured the coal mining industry and has positioned Exxaro and black-owned Seriti as market leaders (Moneyweb 2019). Both companies have a significant portion of contract workers on their respective payrolls. Exxaro employs 6 500 permanent workers and 15 500 contractors (Exxaro 2018) while Seriti employs 3 000 permanent staff and 3 000 contractors (Seriti 2019). This shifting landscape and the impact it has on the number of workers with limited pension cover has implications for social protection in transitions.

Besides the estimated 10% of permanent workers who do not have pensions, the pension gap amongst contractors will need to be considered when planning a just transition for all workers. Pollin & Callaci (2019) recommend that pension shortfalls be covered by government funding.

In South Africa, workers finance their retirement through various sources including employee pensions, old age grants and through personal savings. In Mpumalanga, unemployment levels exceed the national unemployment rate at 36,5% and the expanded rate is 43,8% while more than half of the population live in poverty, with 25% living in extreme poverty (StatsSA 2019). Given that most workers have 3 dependents (Burton 2019), the prospect of miners amassing meaningful savings are remote. The poverty in this region highlights the need for adequate planning to accommodate workers who have families who rely on them.

The following table provides a review of the leading pension funds to which energy sector employees contribute.

Table 5.13: Pension Funds Review

Company	Pension Fund	Assets R(m)	Ranking/100
Anglo Coal	Momentum Anglo American Corporation	50 712 7 849	7 58
BHP, Exxaro, Glencore, Kangra Springlake/Xtrata, Kuyasa	Mineworkers Provident Fund	27 235	18
South32/Seriti	Momentum	50 712	7
Eskom	Eskom Pension and Provident Fund	121 674	1
Sasol	Sasol Pension Fund	45 578	9
Engen	Engen Pension Fund	4 506	89

(Source: Registrar of Pension Funds Annual Report 2015)

Pollin & Callaci (2019) use the following measures to assess US pension fund guarantees:

- Net Income
- Dividend pay-outs
- Stock buybacks
- Unfunded pension liabilities

This approach has been slightly modified to accommodate South African reporting methods however the focus on income, benefits paid, and levels of funding will be still be analysed. This study recommends the following measures for evaluating South African coal mineworkers pension funds:

- Contributions received
- Investment Income
- Benefits Paid
- Surpluses

This modified approach is based on a framework used by senior economist Dick Forslund to evaluate the GEPF (Daily Maverick 2019) and will be applied to the MPF.

Mineworker's Provident Fund

Notably, six coal mining companies have chosen the MPF, including market leaders such as Exxaro Coal. Coal workers' contributions were originally negotiated in collaboration with the National Union of Mineworkers (NUM), United Association of South Africa, Solidarity, and the Chamber of Mines in 2005 and range between 14,5-16,5%, and include 6,5% risk-

benefits as well as separate funeral cover policies (MFP 2018). The NUM and the Minerals Council will need to be included in future just transition negotiations. The fund's most recent statement of assets and funds are captured in Table 5.14, key measures are highlighted.

Table 5.14 Mineworkers Provident Fund: Assets and Funds

Statement of Changes: Net Assets & Funds	**2018**	**2017**
Contributions received and accrued	2 179 898 679	2 264 928 682
Reinsurance proceeds	264 946 477	166 157 488
Net Investment Income	274 973 919	2 967 903 075
Benefit adjustment from unclaimed benefits	601 399 099	419 156 255
Other income	98 628 728	-821 489
Less	-562 896 660	-586 698 197
Re-insurance premiums	-445 600 811	-468 323 358
Administration expenses	-117 295 849	-118 374 839
Net income before transfers and benefits	2 856 950 242	4 392 313 304
Transfers and benefits	-3 331 587 888	-3 695 836 714
Transfers from other funds	28 063 748	1 839 885
Transfers to other funds	-160 398 574	-43 133 709
Benefits	-3 199 253 062	-3 654 542 890
Net (loss) income after transfers and benefits	-474 637 646	696 476 590
Funds and reserves	24 555 833 342	23 859 356 752
Balance at the end of the year	24 081 195 696	24 555 833 342

(Source: Mineworkers Provident Fund Annual Report 2017-2018)

An independent valuator of the MPF describes the fund's financial position as follows: "the assets of the fund were more than sufficient to cover the member liabilities… I do not anticipate that the financial position of the fund would have changed from the statutory and interim valuation dates" (Mineworkers Provident Fund Annual Report 2019).

The actuary's confirmation is echoed by one of their existing clients, Kuyasa Coal, who indicated in the scoping survey that the pension fund is financially healthy and able to meet future obligations(Kuyasa Coal 2019).

While the fund appears to have reasonable reserves and can meet their liabilities, an initial year on year comparison shows a variance in investment income which needed to be buffered

from reserves. Although the MPF appears to be able meet its pension obligations in the immediate future, it is unclear what guarantees are in place for the duration of an energy transition which is expected to last 20-30 years?

Additional analysis of the MPF annual report shows that workers were eligible for home loans, but that could cease if workers no longer receive payments from the fund. There may, therefore, be consequences for workers who withdraw their benefits or reinvest in other funds. An interview with Kuyasa Coal confirmed that their workers do make use of the MPF home loan facility (Kuyasa Coal 2019).

Anglo American describe their South African pension plans as being "in surplus" (Anglo American Annual Report 2017). The company also offers "unfunded medical aid plans," which are extended to retired employees and selected dependents. They note that Anglo's SA pension plans are currently not accepting new members; and that they are not currently making employer contributions noting that most "plans are closed to future benefit accrual". They argue that the provision for health benefits, such as anti-retroviral therapy for staff with HIV, does not impact their post-employment medical plan liability in a significant way. (The weighted average duration of the Anglo's plans is ten years). This review of Anglo's plan reveals workers' needs for medical cover as well as the health services employees have access to while employed.

(Note that Eskom, Sasol and Engen are not included in the review as this study focuses on coal mine workers)

While the MPF and Anglo evaluate their pension funds using similar criteria, how do these compare to industry benchmarks and what norms and policies were used to set these standards?

Forslund (2019) applies benchmarking to evaluate the GEPF and explains that the law that governs this fund stipulates that 90% coverage is required. Coverage is the extent to which a company's assets can cover its liabilities. By comparison, US private schemes apply a rule of 80% to their private schemes while credit rating agencies Standard & Poor's and Moody's & Fitch Group regard a fund as poor if their rating drops below 60%. Forslund asks a pertinent question in his analysis, "Why does the law stipulate a mere 90% funding level? Mustn't all pension obligations be paid?" (Daily Maverick 2019).

He answers his question with an explanation that the “pay-as-you-go” pension schemes rely on the fact that they do not have to pay out pensions to all contributors in one day and generally expect to pay out pensions incrementally over 30-50 years. He further explains that these types of pensions are standard in countries with labour movements, as is the case in the coal mining sector in South Africa.

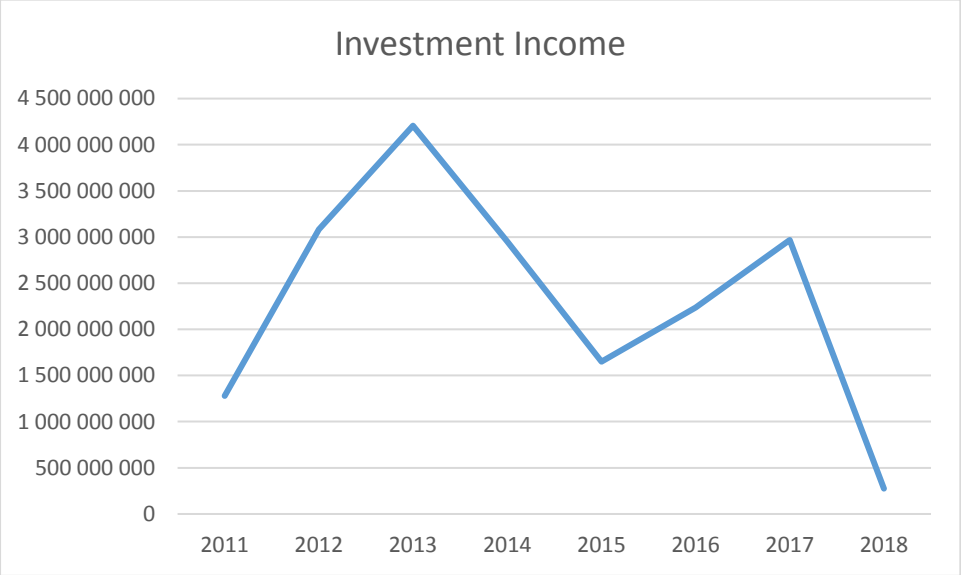
But what does this mean for job losses in energy transitions and how are funds planning to manage the need for increased pay-outs and reduced contributions in energy transitions?

To be able to secure pensions, pension governance laws and agreed coverage standards are crucial mechanisms to ensure guarantees are met. Further to this, the history of the South African pension industry, investment philosophies and market forces have also been instrumental in affecting a funds financial position. Similarly, market volatility, outdated investment approaches and laws may result in exposure to risks. We therefore need to ask if do current laws and policies need to be adjusted to ensure that pensions are guaranteed throughout the transition process?

Forslund (2019) reiterates that in the case of the GEPF, investment cash flows remained untouched for the past 14 years and that “exponential growth” was uninterrupted bar the 2008 – 2009 market crash. “The returns were so ample that finance ministers ignored auditors’ recommendations to increase employee contributions and companies relied on investment returns to bolster reserves” (Daily Maverick 2019).

While the MPF shows a relatively consistent increase in reserves, surpluses and investment income, which is comparable to Forslund’s analysis above, Figure 5.2 shows volatility in investment income over the past eight years, reaching a low point in 2018.

Figure 5.2 Investment Income

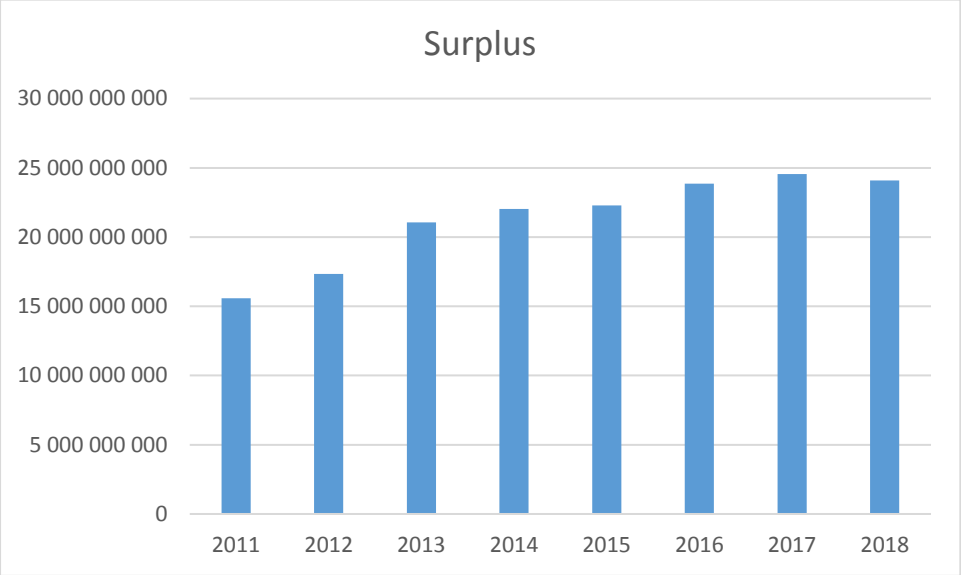


(Source: Mineworkers Provident Fund Annual Report 2011-2018)

Despite this, these shocks were absorbed by the fund's reserves. The impact can be seen in Figure 5.3. While the MPF continues to perform well, it may be necessary to review the fund's investment policy to avoid recent losses, which according to the valuators report, amount to R74m. The fund currently focuses on 40% of its portfolio on capital protection, while the remaining 60% is market-linked and aims to beat inflation (CPI) by 4,5% over three years (MPF 2018).

Over the period under review, the GEPF appears to have experienced similar losses which Forslund (2019) attributes to risky investment strategies with over 50% exposure to equities, which is less than the MPF's at 60%. These similar fates and investment strategies are concerning as the funds are meant to safeguard the pensions of their workers and their dependents.

Figure 5.3 Net Surplus

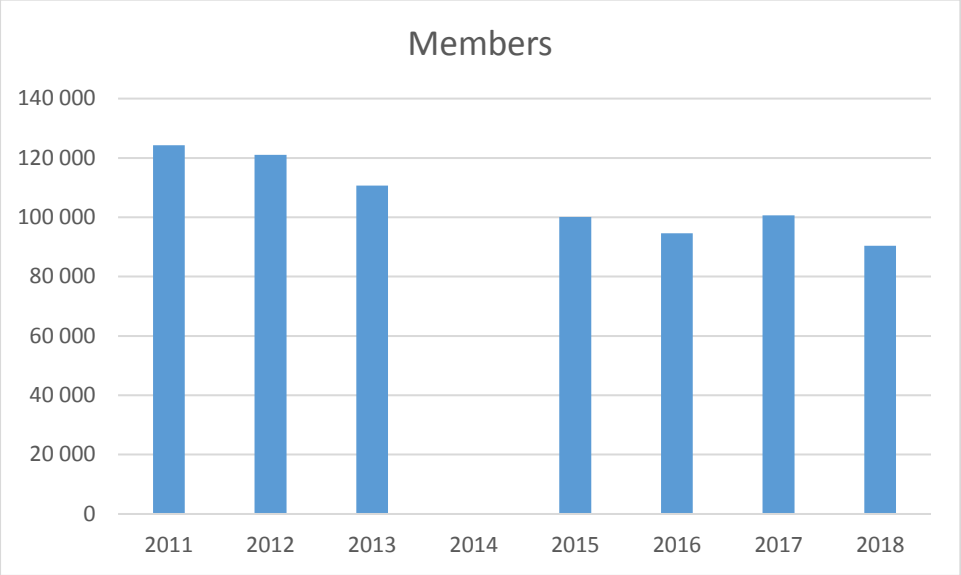


(Source: Mineworkers Provident Fund Annual Report 2011-2018)

This review of the MPF has shown that although surpluses remained solid and have weathered shocks such as low investment returns and large-scale retrenchments, it is not yet clear if the negative trend in 2018 is signalling a decline in surpluses. The fund may face the risk of a fall in membership given the recent market dynamics and emerging energy transition; divestment and the impact of the 4th industrial revolution. It is also being negatively impacted by rising electricity costs. The fund's protection mechanisms must factor these risks in through enabling legislation.

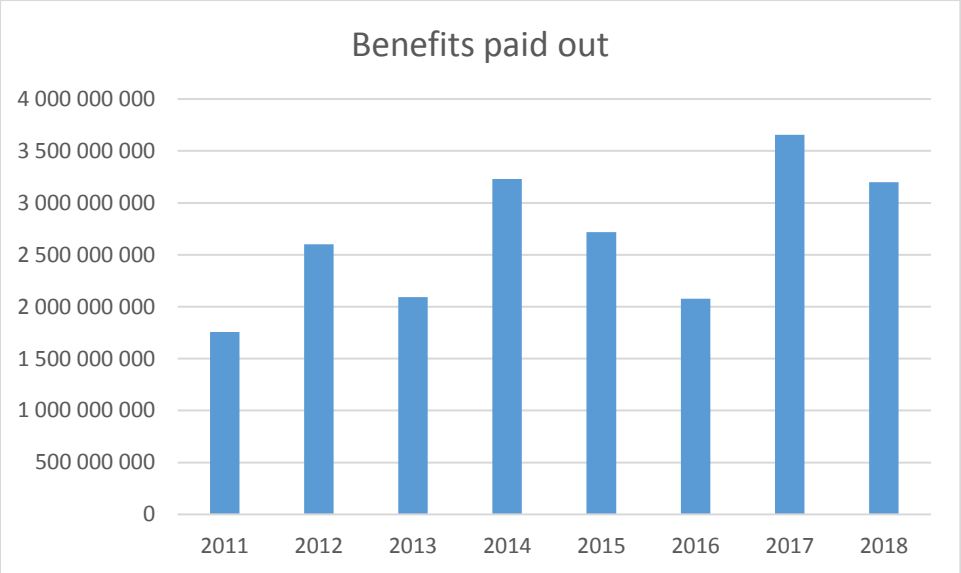
In the comparative case of the GEPF, Forslund (2019) considers the decline in member numbers and benefits paid out in the government fund. The data shows that the MPF members are steadily declining while benefits pay-outs are increasing (Figures 5.4 and 5.5). This was has been especially so in periods of retrenchment in 2012 and 2013, and between 2017 and 2018. (See Figure 5.4).

Figure 5.4 Membership growth and decline



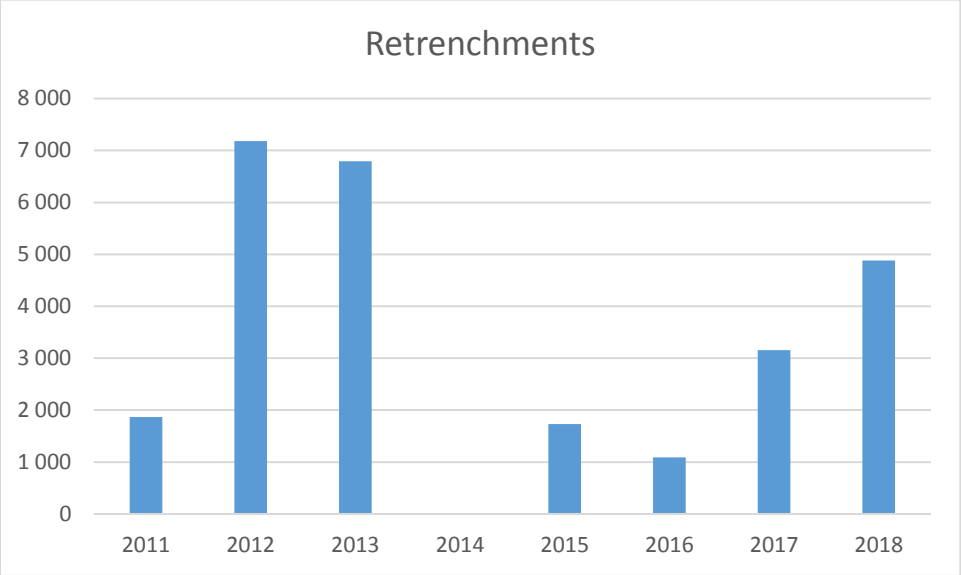
(Source: Mineworkers Provident Fund Annual Reports 2011-2018. Note that data for 2014 was unavailable)

Figure 5.5 Benefits Paid



(Source: Mineworkers Provident Fund Annual Reports 2011-2018)

Figure 5.6 Retrenchments



(Source: Mineworkers Provident Fund Annual Reports 2011-2018. Note that data for 2014 was unavailable)

5.1.8 Age distribution

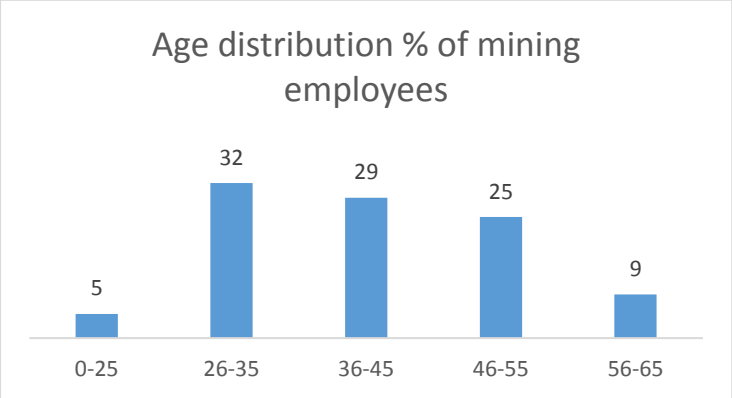
The median age of coal workers is 38 years which is coincidently the same for all mineworkers in South Africa. (TIPS 2019). The Minerals Qualifications Authority (MQA) provides a breakdown of the age distribution of all mineworkers in Figure 5.7. It shows that 66% of miners are 45 years and under, while 34% are over 46 years (MQA 2014). Data from Kuyasa coal mine (Figure 5.8) shows that 63% of Kuyasa coal miners are under 45, while 37% are over 45. Although the Kuyasa coal data correlates with the MQA's data, the number of employees at Kuyasa Coal is only 385, so the sample may not necessarily be representative.

The age distribution can be further estimated using inferential calculations based on the median age of 38. The median is applied to the total number of coal workers, 82 247, in South Africa. (Quantec 2017):

If the median age is 38, then half, i.e. 41 124 employees are either over or under 38 years old. The age span could not be more than approximately 40 years, given that the average life expectancy is 60 for men in Mpumalanga (Stats SA 2019). If half the number of workers take 20 years to reach the median age of 38, 6 more years to 44 will include 12 337 workers in the

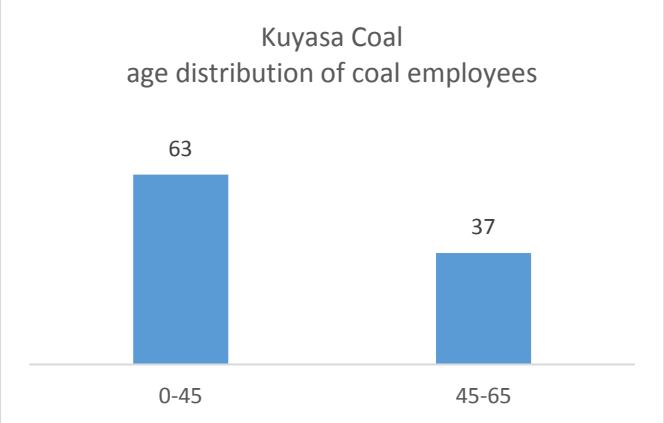
spread totalling 53 461 under 45 with 28 787 45 or over. Therefore, the age split is estimated at 65% of workers being under 45, with the remaining 35% being over 45. This percentage ties up with both the MQA and Kuyasa data. This percentage will, therefore, be used to calculate age in the age scoping survey.

Figure 5.7 Age distribution: SA miners



(Source: Mining Qualifications Authority 2014)

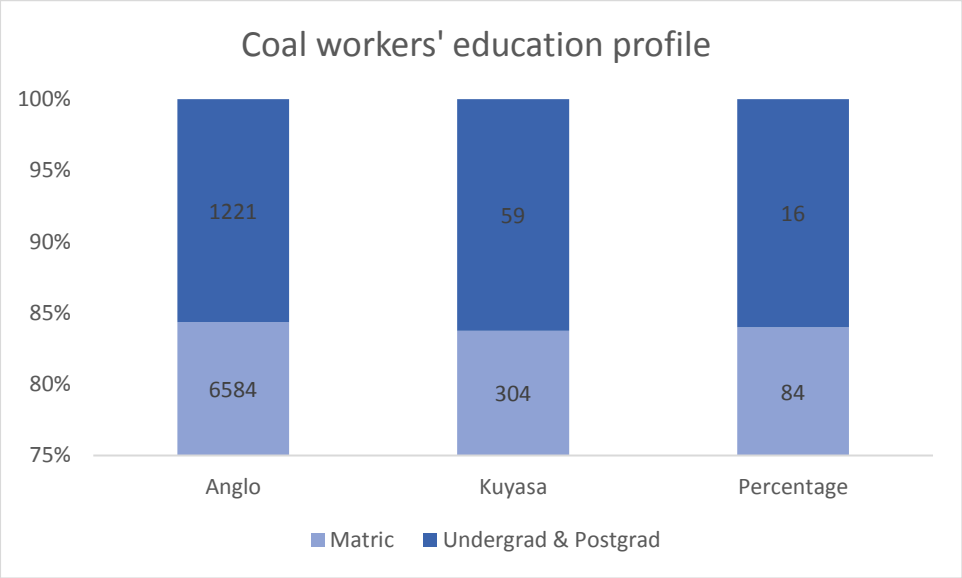
Figure 5.8 Kuyasa Coal: Age distribution



(Source Kuyasa Coal Scoping Survey)

5.1.9 Education Profile

Figure 5.9 Education Profile



(Source: Anglo SLP, Kuyasa Scoping Survey)

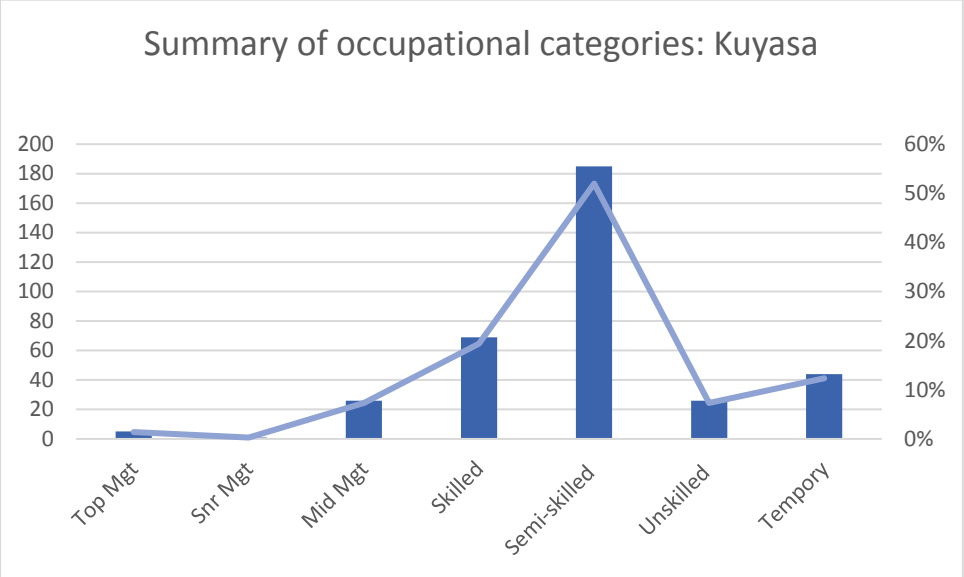
The scoping survey found that 84% of coal workers have matric, but only 16% have an undergrad or postgraduate qualification. This is lower than the 75% of workers with matric that has been estimated previously (TIPS 2018) and could have an impact on the transferability of skills. However, artisanal skills which are typically found in the mining sector, can have significant value and can be transferable. Figure 5.10 indicates skills levels at Kuyasa Coal. The graph shows that the majority of workers are either skilled or semi-skilled.

To be able to analyse occupational categories, skills are defined as follows:

Definition of Skills Categories by IKI (2019):

Unskilled	Limited skills and education
Semi-skilled	Has basic knowledge yet lacks specialised skills
Skilled	Has specialised skills and tertiary education at university or vocational college

Figure 5.10 Occupational categories: Kuyasa Coal



(Source: Kuyasa Coal scoping survey)

5.1.10 Occupational Profile

Table 5.15 Kuyasa Coal Occupational Profile

Mining		**Plant**	
Mine Manager	1	Bell driver	4
Mine Overseer	2	General workers	13
Shift Supervisor	6	Metallurgical Manager	1
Miner	14	Metallurgist/Foreman	3
Trackless Equip Operator	57	Operator	17
General Worker	46	Analyst	2
Engineering		**Human Resources**	
Engineering Manager	1	HR Manager	1
Assistant Engineer	2	HR Officer	3
Foreman	10	Administrator	4
Handyman	1	General Staff	2
Artisan	41	**Executive Management**	
Serviceman	14	Assistant GM	1
Engineering Assistant	4	CEO	1
Financial		**Specialists**	
Financial Manager	1	Safety Superintendent	1
Buyer	1	Occupational Hygiene	1
Administrator	3	Environmental Specialist	1
General Staff	2		

(Source: Kuyasa Coal Scoping Survey 2019)

The Kuyasa Coal Occupational Profile on page 97 provides a detailed breakdown of skills across various specialisations, which consist mainly of mining, engineering and plant management.

5.1.11 Transferability of Skills

In terms of transferability, a US study by Louie and Pearce (2016) indicates that there are sufficient opportunities for coal sector workers in the solar industry, but that workers would require retraining. Another study by the EC and ILO (2011) indicates that the skills of electrical engineers, electrical technicians, electricians and information technology specialists are directly transferable to renewable power plants.

Table 5.16: Comparative Occupational Composition: Australia & SA (%)

	SA1 KUY	SA2 BHP	AUS	SPV Cons	SPV Man	SPV O&M	OnW Cons	OnW Man	OnW O&M	OffW Con	OffW Man	OffW O&M
Managers	6	2	6.7	1	4.2	6.3	1.7	7.6	1.5	2.2	4.6	3
Other professions	7	9	10	5	12.7	4.4	10.6	11.3	11.6	7	26	15.8
Engineering	1		0	3.8	14.3	14.7	1.8	8.7	27	6.2	6.3	7.7
Technicians	27	11	7.5	7.2	6.3	26.2	27.8	6.5	46.9	0.1	3.5	25.1
Clerical	0	1	5.1	3.3	4.9	1.3	0.3	4.6	4.7	0.2	9.2	8.4
Construction	0		0	0.8	0	0	9.9	2.5	0	0	2	5.5
Metal Trades	0		16.3	1.8	7.9	0	7.9	28.4	0	0	23.3	0
Electricians	0		5.5	14.2	21.6	32.3	13.8	4	4.1	0.2	3.3	5.5
Plant & Machine	15	74	46.4	55.6	10.6	0	21.9	18.3	0	12.9	15	20
Elementary	45	2	2.6	7.4	17.5	14.7	4.3	8.2	4.1	0.8	6.7	8.9

(Source: SA 1 = Kuyasa Coal (n=262); SA2 = BHP Billiton Coal (n=2230) Social and Labour Plan data; AUS = Australia; SPV = Solar Photovoltaic. Across Manufacturing, Construction and Operations & Maintenance Categories, Dominish et al. 2019)

Using occupational analysis methods, Dominish et al. (2019) compare occupation categories across renewable technologies and fossil fuel industries. Table 5.16 uses their findings for coal and solar PV in Australia and compares this to Kuyasa and BHP Coal's occupational profiles. There are some similarities in both countries in terms of management, 'other

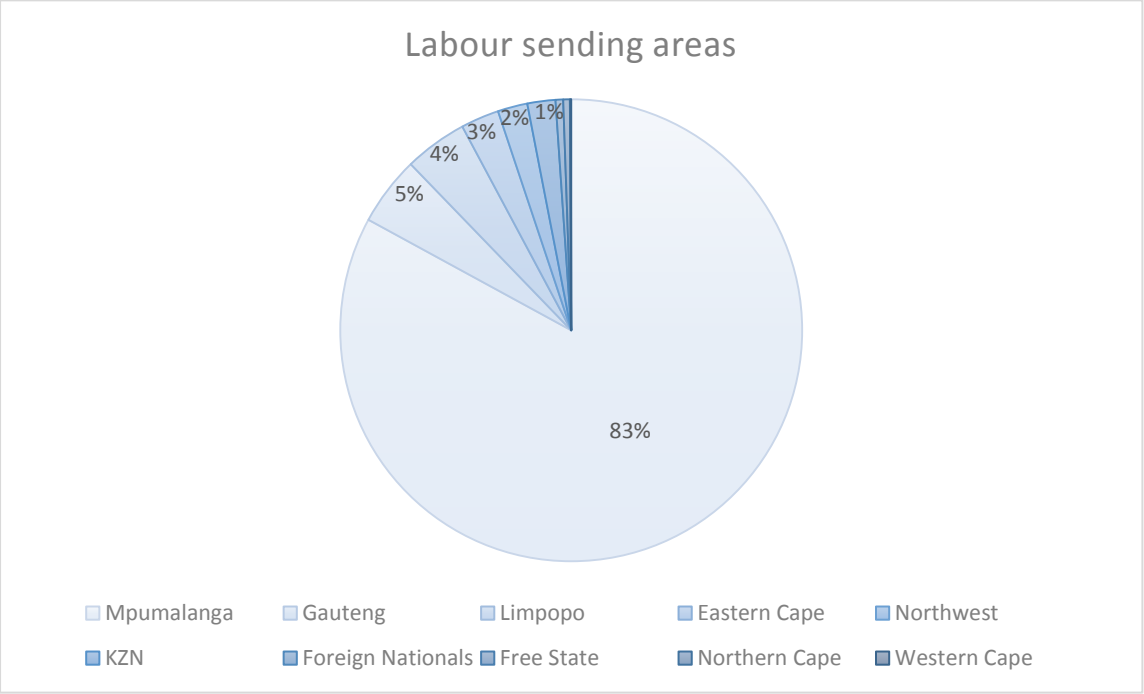
professions' and plant and machine categories which implies transferability. Kuyasa has more employees in elementary positions. This could indicate that more intensive training may be required for 'in-demand' SPV categories, such as plant & machine (short-term) electricians, engineers and technicians (long term). However, during the interview the representative from Kuyasa revealed that all mineworkers have a minimum of matric with Maths and or Maths & Science, meaning that all employees appear to be highly trainable.

5.1.12 Dependency Ratios

According to the Provincial Treasury, coal workers in Mpumalanga support at least three dependents (Provincial Treasury 2015). The SLP of Kuyasa suggest that ratios may be higher and that workers may have between 5 and 10 dependents. The livelihoods of dependents need to be accounted for when considering potential job losses.

5.1.13 Displacement of workers in transition

Figure 5.11 Labour sending areas



(Source: Social and Labour Plans: Kuyasa 2016, BHP 2012 & Xtrata 2009-2013. n=4326)

Mining SLPs indicate labour 'sending areas', referring to areas that miners originally relocated from. Although miners (83%) in Mpumalanga are from the province, a significant portion come from surrounding provinces, e.g. Gauteng (5%), Limpopo (4%), KZN (3%) and Eastern Cape (2%). Many of these workers may have dependents in these provinces and could potentially be reunited with their families when alternative forms of employment are considered. This could should be explored by including neighbouring areas in partnerships with municipalities, employment agencies, and the private sector.

5.2 Finding the heartbeat of Emalahleni

This section explores a context-based approach to a just transition in coal mining areas, in Emalahleni, Mpumalanga. It does so by comparing just transition strategies and theoretical frameworks to specific local contexts. This approach places emphasis on local dynamics.

Community observations, hosted by GroundWork, were conducted using qualitative methods in Emalahleni in July 2019. The respondents included coal mine workers, union representatives, community members and local NGO's. Additional interviews were conducted and analysed as themes emerged from the process. Interviewees included representatives from CTC Colliery Training Centre, TIPS Trade and Industrial Policy Strategies, Kabi Solar and Kuyasa Coal.

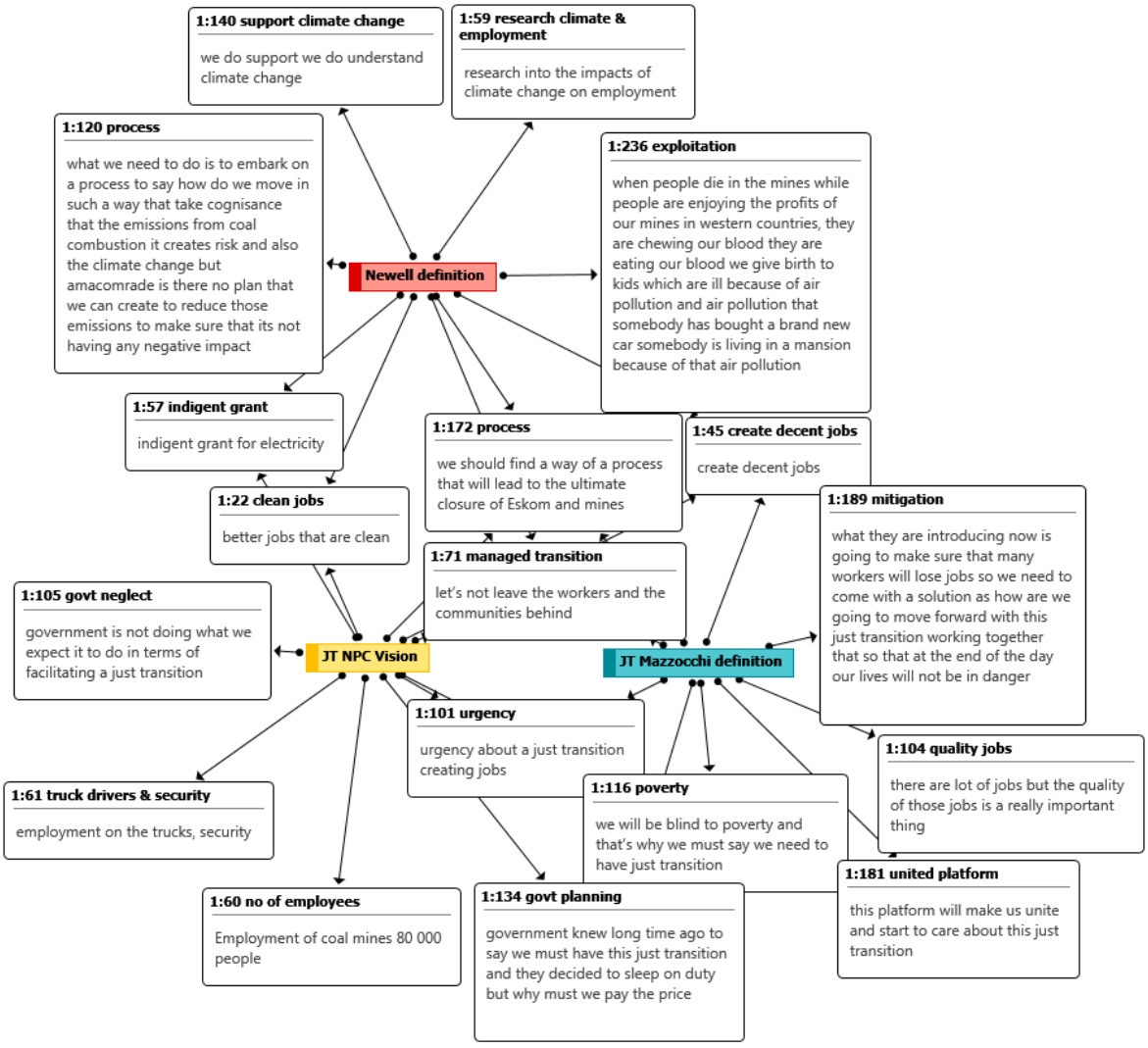
5.2.1 Community perceptions of a Just Transition

The community observations reveal that the Emalahleni community understands the broad concept of a just transition. Figure 5.1 maps their perceptions against definitions by Newell, the NPC and Mazzocci described in the conceptual review.

These findings indicate that the just transition concept is understood meaning that there is no need to introduce the concept to communities. Rather, efforts should be geared towards implementation and allaying the fears workers face. However, the sample is not representative of the full community, rather it includes union representatives, community activists, workers and some community members.

The analysis shows that despite their fear of job losses, disillusionment and concerns regarding government and union inaction, the community remains hopeful. The community is prepared to be involved in a positive just transition process, and their courage is illustrated by this comment: "This platform will make us unite and start to care about this just transition".

Figure 5.12 Community perceptions of a just transition



Source: Emalahleni Community Observations, Civic Theatre July 2019

In summary, some key concerns are expressed by the quotations in the table below.

Table 5.17 Community perceptions of a just transition

Fear of job losses	Government planning	Concerns re Unions
What they are introducing now is going to make sure that many workers will lose jobs, so we need to come with a solution as to how are we going to move forward with this just transition working together so that at the end of the day our lives will not be in danger.	Government knew long time ago to say we must have this just transition and they decided to sleep on duty but why must we pay the price? Why can't government themselves move to amarenewables? government is not doing what we expect it to do in terms of facilitating a just transition.	The unions, they forgotten about the issues, they are now focused on politics and the issues of the workers are forgotten. That's why the unions are losing momentum because the only time you will see the union comment is when they have removed one of the ministers. When did you last hear - all the unions do is the retrenchments.

(Source: Community observations by author in Emalahleni July 2019)

The procedural, distributional and restorative frameworks of justice, applicable to a just transition were introduced in the conceptual analysis (McCauley & Heffron 2017). The community's concerns about climate change and grievances about governments and unions relate to the principle of procedural justice. Their meeting, which was a founding meeting for a community platform is a space where discussions are taking place in the interest of justice.

The outcomes of procedural justice, such as the development of, or changes to, laws and policies seem largely absent in this community observation, with the exception of the COSATU Climate Policy introduced to workers by Naledi. The principle of restorative justice may include community efforts to move towards remedial action. However, the 'perpetrators' would need to be involved, who in this instance, would likely consist of mining companies and government and to a degree, unions. So, the constructive dialogue between community members and unions could be considered restorative. These community dialogues, therefore, seem to have value and potential in restoring justice and moving toward practical, procedural outcomes.

5.2.2 Health and Compensation

The Life after Coal campaign reports that pollution from Eskom's coal-fired plants kills 2200 people per year. In addition, it states that there are 12 314 cases of childhood bronchitis per year , and 94 680 days of asthma experienced by children every year. A just transition promises cleaner air and therefore less pollution-related illnesses and prevents the burden from falling on to those who cannot afford treatment.

The Emalahleni community observation showed that workers feel caught between the need for a job and the impacts of coal mining on their health, their children's health, and community and culture. Table 5.18 below highlights key findings.

Table 5.18 Community perceptions: impact of mining

Community Comment	Theme
We are in a catch 22 situation because when the mine is operating, we could die and when the mine is not working people die.	Poverty
We, as the community know where I'm coming from to resist mining. When we fight it, we address our concerns about those mines who are polluting our air and our water those people who are working in the mines they see us as enemies who are coming to take their jobs and but we want to close down these mines there will be no work.	Dividing the community
Our culture, our water, our air quality is compromised.	Health and Culture
My son was forced to come home from school early and at that time the biggest problem was that I couldn't even afford to get him proper medication.	Health and Poverty
Give us better jobs that are clean that we are free from pollution that we are free from sicknesses that we are free from any kind of disease.	Health and Alternatives
I have never seen a report that says this is what you are exposed to when we start mining coal and when we start transporting it will endanger us in the road, but it must be clear so that we all understand to say when we mining coal these are the risks.	Health and Lack of transparency

(Source: Community observations by author in Emalahleni July 2019)

The community recalled various accounts of illness including eye problems, respiratory diseases and asthma, especially amongst children. They directed their anger towards mining companies to varying degrees. The most visceral comment being:

> When people die in the mines while people are enjoying the profits of our mines in western countries, they are chewing our blood they are eating our blood. We give birth to kids which are ill because of air pollution and air pollution that somebody has bought a brand-new car somebody is living in a mansion because of that air pollution. (Elvis, Coal worker, Emalahleni 2019)

Despite overwhelming evidence of significant health concerns, health and compensation have been neglected in the mining sector in South Africa. In 2018, an evaluation by the South African Human Rights Commission (SAHRC) found that the mining sector continues to neglect to meet environmental and land use obligations which affect health compensation and the rights of communities to decent work and safe working conditions.

Globally, concerns about the health risks associated with pollution have been growing in places like Beijing, Canada and India (GSI 2018). In India, as many as 1,3 million deaths are reported annually mainly due to pollution from coal plants (Health Effects Institute 2018).

The international case studies show that linking health risks to just transition narratives increase awareness and empathy for workers and communities living near mines and power stations and sets it within broader climate change narratives.

There is clearly scope to ensure that health concerns are addressed during just transition processes within the community of Emalahleni. The divisive effect on communities should be considered when managing social dialogues, and mediation may be required when the interests of jobs versus health come into conflict. National just transition implementation plans needs to include, health and safety standards.

5.2.3 Just Transition for whom? GenZ Boomlets and beyond…

Steyn, Burton & Steenkamp (2018) emphasise the importance of contextual data such as workers age, skills and educational profile as a necessary first step in designing a just transition. As mentioned in the introduction, not all labour data is accessible despite being crucial to the ability to calculate costs associated with the retraining of workers. Various

expert interviewees from the coal sector provided some qualitative insights into the labour profiles of existing workers.

Johan Venter CEO at the CTC in Emalahleni asserted that coal mineworkers are well-educated and trainable. He argues that their skill levels are higher than within other sectors. He says this is the case because the industry mechanised before other sectors, and because coal companies insist on matric, or is N3 certificate equivalent, as minimum entry requirements. He added that even a trainee miner requires a minimum of grade 11. Venter stated that CTC's qualifications are recognised throughout the world.

Ayanda Bam, CEO of Kuyasa Mining, confirms that matric is a minimum with maths and preferably science which he states are necessary for the upskilling of workers. Ayanda says "we won't take you if you don't have matric as a minimum requirement even if you are going to be an operator, you must have matric and for you to be able to have a future, you must have mathematics because that means we can train you to be an artisan" (Bam 2019).

A just transition requires a long-term view. And when one considers the skills and needs of the future generation of workers, new factors such as intergenerational and family dynamics come in to play. When developing a just transition plan, these will have to be factored in.

Ayanda suggests that the skills profile of learners in the region may be changing as learners choose subjects like tourism ahead of maths. He lamented the fact that teachers do not encourage learners to study maths and science. SADTU (2017) confirms that 5 139 teachers in South Africa are unqualified or under-qualified, many of whom are expected to try and teach maths and science which will have an impact impact on learning outcomes.

Mike Levington, MD of Kabi Solar imagines that a just transition may consist of a series of compensation packages, which ideally includes what he describes as a 'pink ticket' (education subsidy) for a family member of a retiring mineworker. In this case, the challenge of sub-standard foundation skills needs to be factored into cost planning.

Gaylor Montmassen-Clair, a sustainability economist at TIPS, agrees. He argues that the focus should not only be on existing employees, who may be able to recover from the transition, but also on the next generation "who were expecting to work in the industry and for whom jobs will not be available".

The concerns and possibilities raised by the three region sector experts are consistent which has significant implications for skills development and the costs of a just transition.

The OECD reports that the UK-based Coalfields Regeneration Trust (CRT) implemented the Family Employment Initiative (FEI) which adopted a 'whole family approach' by targeting family and friends to ensure that compensation was shared amongst family members. The initiative also provided services including healthcare, housing and debt advice. The CRT offered a Community Future Programme, community grant and Youth Upstart. The OECD acknowledges, however, that the worker transition programme was not entirely successful, and that high unemployment persisted amongst retrenchment workers. Concerns about this programme's effectiveness were also raised by various local researchers (Burton, Montpassen-Clair and Halsey 2019).

In summary, there needs to be a focus beyond existing workers that includes the following and future generations of potential workers. In this regard, the establishment of a sustainable industries must be the goal of any just transition. There are opportunities to design programmes aimed at families and communities offering extended services. However, these would likely need to be developed collaboratively to suit the local market.

5.2.4 Exploring Alternatives

In a discussion led by Sizwe Tyiso from NALEDI a proposal was recommended to the community and discussed. This proposal followed a summary of COSATU's policy on climate change and articulated a vision of a just transition to low carbon and climate-resilient economic policy

Sizwe initially highlighted the right to decent jobs, the possibility of clean jobs and the need to reskill existing workers as well as the next generation (which correlates with the previous section). He cautioned, however, that renewable energy alternatives might not necessarily offer permanent job prospects.

He proceeded to recommend mine rehabilitation as a promising alternative to create jobs and recognised that there were several abandoned mines and substantial funds paid for rehabilitation that were sitting idle. He appealed to communities to engage around this issue to ensure the release of these rehabilitation funds.

During the meeting's closing, Sizwe concisely reiterated his proposal and summed it up as follows:

> Comrades I have been listening to everyone, and the one thing I can say is there's this English saying that you eat an elephant one bite at a time. And the first bite that we can all agree on is the issue of rehabilitation. It is one of the things that can create jobs and address the environmental degradation that's happening. That's one thing we can agree on yes one thing I'm am hearing that we are agreeing on is rehabilitation, and the rehabilitation funds are somewhere. We must find them and campaign to start the rehabilitation process that's the one thing that we can all agree. If we can get that galvanise unions, community organisations and push the issue of rehabilitation at least that will be the first step it's still going to be a long road to get to where it is; we are trying to go. But for me, rehabilitation is the one thing that I hear we've got common voice on.

While there tends to be a focus on renewable energy jobs as alternatives in global just transition literature, local sector experts argue that RE is not necessarily the most suitable, or the only alternative in South Africa. Concerning rehabilitation, interviewee Mike Levington agreed that substantial funds have been set aside in mine trusts for rehabilitation and that rehabilitation is an alternative that should be considered. He suggests that mine closure processes present an opportunity to secure proper rehabilitation through the allocation of mine closure licences. He proposes that the enforcement of regulatory measures could obtain the necessary resources for rehabilitation and stresses that there are already over 600 abandoned mines in South Africa posing significant social and environmental risks. According The Guardian (2019), there are 6 000 abandoned mines in South Africa. The closures present an opportunity to develop a comprehensive plan that includes rehabilitation, wastewater treatment, agriculture and renewables.

He also suggests that the transition creates an opportunity for the development of a mixed green economy that can include a variety of industries, such as green hydrogen, power fuels, batteries, and secondary industries in the value chain. He has also proposed to the DEA that the next round of REDZ (Renewable Energy Development Zones) should include mining areas such as Mpumalanga for renewable energy.

Gaylor Montmassen-Clair of TIPS firmly agrees that a plan for the region is imperative. "We need a bigger plan to rejuvenate and redevelop the coalfields and some of that can be brought by renewables, but it won't address the problem, we are not trying to fit in renewables if it doesn't make any sense."

Montmassen-Clair is currently researching the energy value chain across five sub-sectors namely coal, metals, liquid fuels/automotive, tourism and agriculture. He is assessing the number of employees, their skills and education levels, the extent of, their unionisation to estimate the impact of job losses. TIP's labour data will be used to design resilience plans to reduce vulnerability and focuses on workers, communities and small businesses in targeted areas within the Mpumalanga province.

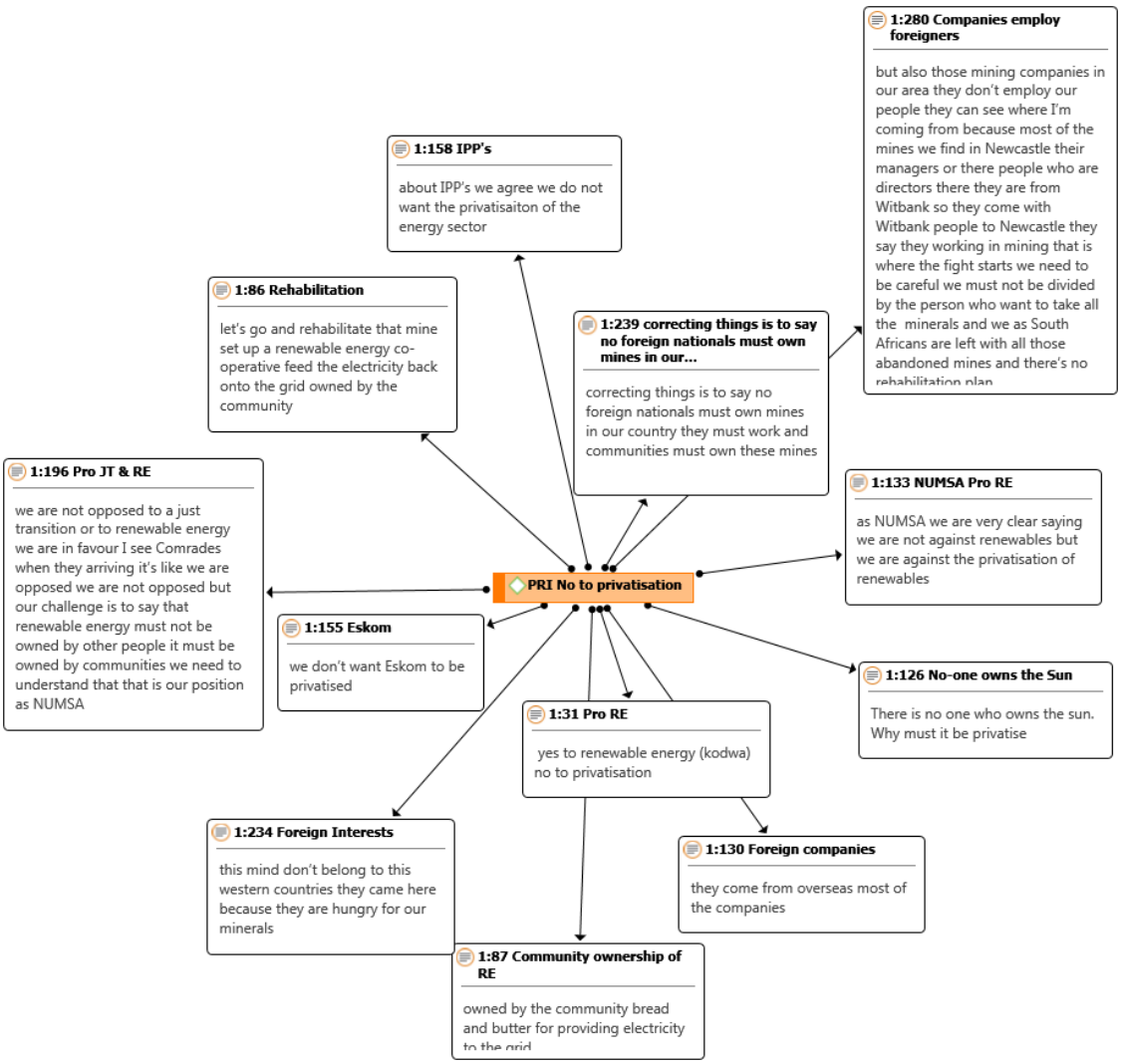
Global literature emphasises regional policies, actors and governance as well as local employment agencies, customised training initiatives, regional economic diversification and impact assessments (UNFCCC 2016, OECD, GSI & Burton 2019).

There is a consensus that rehabilitation presents an opportunity for employment in coal mining areas in Emalahleni and beyond, and that there are funds available. Further to this, a regional development plan is recommended and should ideally include diverse green industries. Research is currently being done by TIPS to assess skills and sector-based opportunities. It's essential to understand the skills required for potential sectors to be able to train the workforce to serve these needs. Partnerships have to be built with future employers so that they contribute to a just transition and inform sector skills requirements.

5.2.5 No-one owns the sun

Community ownership of energy infrastructure and resources is a sensitive issue amongst community members, workers and unions in Emalahleni. The community questions the history of private ownership of mineral resources in the province and feels that the transition presents an opportunity to negotiate locally-owned initiatives. Unions asserted that they can see the benefit of RE and a just transition and are interested in having discussions about local ownership for communities in Emalahleni.

Figure 5.13 Community perceptions of privatisation



(Source: Community observations by author in Emalahleni July 2019)

The conceptual analysis in this thesis showed that without the necessary directionality of ownership, financial flows and accountability, an unjust transition is likely (Swilling 2019).

The analysis of perceptions of ownership highlights a delicate stage in the energy transition as large-scale RE infrastructure is likely to be introduced into the province for the first time (Levington 2019). It's likely that RE will be introduced through the DEA's Regional Economic Development Zone (REDZ) (Engineering News 2019) as well as via regional development initiatives to manage the energy transition. Analysis shows that the community are against privatisation.

Mike Levington, who owns a solar energy company that is likely to be included in the roll-out discusses what ownership means. Levington (2019) proposes a 5% share to communities which is at the top end of the range of 2,5-5% that is industry standard in the REIPPPP programme. According to the latest IPP Report (2019), the actual range for community ownership in practice is 9%. The Emalahleni communities' idea of ownership leans towards a more inclusive approach to community ownership and even the uppermost adjusted range of 9% may likely be disappointing for the community of Emalahleni. Levington (2019) concludes that more diversified community ownership would equate to a just transition where small companies have their own PV via local distribution companies which integrates ICT with a smart grid to provide energy services. Distributional and restorative dimensions of justice would be applicable in this instance. However, restorative policies need to be in place to create the environment for communities to have access to ownership.

5.2.6 Mondragon Co-operative University

During the interview with Mike Levington, he describes the Mondragon Corporation as an example of regional innovation in north-west Spain. He states:

> In the Franco era, it was about Basque determination they set up these micro cooperatives. But they traded amongst each other - now Mondragon has its own university. It's got some of the biggest engineering companies, and they were the first people going into renewable energy that's our fathers in RE, they come from there, and they are now huge companies. Every seven years they have a review, and they say what are the new sectors how should we train people to go in, and that's the model labour needs to look at and they need to say right we can have our own universities in Mpumalanga. (Levington 2019)

The OECD conducted a review of Higher Education in Regional and City Development in the Basque Region in 2013, and the following section summarises how the Mondragon Corporation and University featured in the review.

The report was comparative and included all universities in the area. However, this summary only features Mondragon with comparisons, where relevant. In light of the interview with Mike Levington and his focus on the Mondragon experience as a model for Mpumalanga, this co-operative model is explored in detail.

Mondragon University is recognised globally as an innovative, regional university that combines practical learning and theory with employment. Students spend half-day in the classroom, and the rest at work. This industry-led approach affords students the benefit of work experience while being able to pay for the cost of their education.

The 40-year old university attributes its success to its association with the Mondragon Group. Mondragon University approaches tertiary education in an integrated way providing a model-approach by creating pathways between the university and vocational training. The OECD report indicates that the university has lower drop-out rates compared to other universities in the Basque region.

The university is a co-operative member of the Mondragon Corporation which was created in 1956. The corporation seems to combine what the OECD (2013) describes as "democratic principles and the aims of an internationally competitive business" which strives to advance its workers and is committed to job creation and social development. The Corporation is the largest business group in the Basque Country and the seventh-largest in Spain. The Mondragon co-operative case study has received recognition worldwide. A mostly positive review in OECD's (2013) report outlines the model in more detail and will be used to assess in terms of the key research questions being asked by this thesis.

Mondragon Corporation focuses on collaborative research in partnership with companies and uses technology roadmaps to identify industry-specific technology needs.

In 2013 Mondragon Corporation:

- consisted of 281 co-operatives and companies
- employed 83 569 workers (just under 10% of all Basque region's workers)
- earned EUR 14.8 billion in revenue
- maintained finance, industry, retail and knowledge sectors cooperatives
- had 14 technological centres for research and development in the region
- collaborated with 1 885 researchers from the university
- had four faculties which operated as self-sustainable co-operatives

Table 5.19: Mondragon university students by level and year, 2006-2010

	2006	2007	2008	2009	2010
Undergraduate	3327	3248	3103	3031	3018
Masters	188	328	290	316	483
Doctorate	121	131	149	107	109
Total	3636	3707	3542	3454	3610

Source: Puukka & Charles (2013)

Mondragon University is part of a co-operative system where employees share ownership by buying into the co-operative via the donation of one years' salary. This payment averages between EUR 14 000-15 000. As a reward, members annually receive 3-6% of their annual salary subject to funds being available. The university caps salary differences at a ratio of is 1:3 to promote equality while the highest and lowest wages are controlled.

Funding

Although Mondragon university's income comes from a diverse range of funding sources, a significant portion is made up of student fees. The university's work-study system offers students work experience, which translates to salaries which cover the costs of their studies.

Compared to universities in the area, Mondragon has a significant contingent of lifelong students (4000) i.e. students who continue to study throughout their lives, which brings a constant source of income to the co-operative increasing its sustainability, covering 6% of its entire budget. Also noteworthy is the contribution of the private and public sector.

Table 5.20 Mondragon University budget structure 2006-2010

Year	2006	2007	2008	2009	2010
Fees formal education	42.6	40.9	39.8	40.3	42.2
Fees lifelong learning	7	6.5	6.8	5.7	5.8
Public sector competitive	12.9	15.7	17.5	16.3	17
Public sector non-competitive	7.6	6.9	7.5	7.5	9.5
Firms	13.5	13.9	14.8	17.9	15.5
Other	16.4	15.8	12.8	9.6	10

Source: Puukka & Charles (2013) The role the Basque Government plays in funding is limited.

In 2010, the government's University Plan funded 9% of Mondragon's total budget.

Table 5.21 Public funding of Mondragon university in EUR (m)

University	Instrument	2011	2012	2013	2014	Total
Mondragon	Contract	4	5.5	7.1	9	25.5

Source: Puukka & Charles (2013)

Table 5.21 shows that public funding of Mondragon university has increased consistently year on year for the past four years. This is an indication of confidence from the public and credibility on the part of Mondragon university.

Employability

Mondragon University has been able to develop a large number of collaborative research programmes with companies in the region. This research model involves a technology committee, which is formed in partnership with the university, companies and additional technology partners to develop technology roadmaps. These roadmaps sets out 3-4-year agendas on future technology opportunities in particular industries. The university uses the roadmaps to pinpoint potential projects and the budgets they can offer to industry partners. They then implement selected projects according to the needs of industry partners, through teams involving academics and students. The outcomes from the projects are monitored and fed back to the technology committee. While the core team of these technology committees are from the Mondragon group, other local firms from outside of the co-operative movement are invited to participate. The benefits from this model include the development of mutual trust, expansion of R&D activities, alignment between the university's research teams and companies, in addition to the shared technical expertise. This model changes the way customers, suppliers and students work through collaborate design culture.

The Basque unemployment rate is 15,5% which is lower than Spain's 25% and Mondragon University students' 13% and the youth unemployment rate of 30%. (Note that these rates were at the height of the 2007/2008 stock market crash.

Table 5.22 Unemployment rates Basque region vs Mondragon University

	Basque	Mondragon
Year of Graduation	2002	2007
Interviewed IV year	2005	2010
No of students	696	832
Labour market participation	96.6	91.9
Unemployment rate	5.7	13.2
% employed through the university	28	26
Average salary		1514
Employment with right qualification	89	92.7
Staying in Basque	94	90.1

Source: Puukka & Charles (2013)

Integrated Education

Mondragon University has forged working links between the university and the HVET system. They facilitate an integrated tertiary education system by maintaining strong relationships with other universities, HVET institutions and schools. One essential initiative is the designing of pathways for the Basque Qualifications Framework. Collaborative efforts ensure that these pathways are supported by credit recognition schemes; course and programme articulation agreements; the acknowledgement of prior learning; alternative selection mechanisms; clear policies related to credit transfer; and, increased support for joint and collaborative programmes.

Co-operative Governance

Mondragon University engages the entire university community and key stakeholders in decision-making via a co-operative governance system. Mondragon University is a co-operative university, based on a legal model of a co-operative enterprise. The university consists of five co-operative entities, each with their own legal capacity. These include four co-operatives, each 'owning' one of the universities' four faculties. The fifth co- operative, Mondragon Unibertsitatea S.Coop., is a "second-order co-operative" made up of the other co-operatives, as well as some additional companies and institutions. All the five co-operatives have standard co-operative management bodies: A General Assembly; an Advisory Board;

and, and a Board of Directors. The General Assembly holds supreme power for each of the co-operatives.

Mendeberri Method

Mondragon University is based on the Mendeberri model, which values labour market contacts and employability skills. This combination has been effective in achieving graduate employability. On average Mondragon university graduates take an only 3 months to find a job.

The Mendeberri method allows for student's independence as well as teamwork and engagement across various disciplines. Learning takes place in intimate groups overseen by a tutor while team members are responsible for their studies.

Staff performance

The university staff have adopted a performance system from the corporate world, including performance targets agreed upon between staff and management. Annual appraisal, financial rewards and peer management are standard mechanisms for ensuring that performance standards are met. Mondragon University is management via a co-operative governance system.

Employment Partnerships in SA

Partnerships between employers and vocational colleges are actively being explored currently GIZ, a German development co-operation supports this initiative on behalf of BMZ (German Federal Ministry for Economic Co-operation and Development). In a nutshell employers aren't happy with student/college performance and the colleges don't believe the employers support them enough. This partnership can be developed further.

5.2.7 Education Infrastructure in Mpumalanga

Education Infrastructure in Mpumalanga

The following section gives an overview of the education infrastructure in Mpumalanga. It then analyses post-school data to understand what the sector trends are and what opportunities there might be for a co-operative university.

The municipal districts of Nkangala and Gert Sibande are located within a network of public and private colleges. Emalahleni, Gert Sibande, Nkangala each have a public TVET (college. Nkangala's TVET college is the biggest and offers a wide range of courses including engineering, IT, tourism and business (Nkangala TVET College 2019).

There is also a university located in the province in Mbombela (formerly known as Nelspruit), which mainly focuses on agriculture, education and hospitality. These sectors align with the growth sectors identified by the provincial government as 'agriculture, tourism and mining' (Mpumalanga Provincial Government 2015). However, the university is located 215km from the town of Emalahleni and 267km from Govan Mbeki. It would be closer for ex-coal employees to travel to universities in Johannesburg, which is located 139km and 135km from the respective towns if vocational colleges do not meet training needs.

Figure 5.14 Education infrastructure in coal mining areas of Mpumalanga

(Source: Google Maps)

Post-School Education Landscape in South Africa

In South Africa, the DHET recognises TVET colleges and HEI's as the post-school system. The following table provides the number of students enrolled in these broad categories:

Table 5.23 Post-school landscape in SA

Post School Institution	2017	2016	Target 2030
Public Higher Education Institutions	1 036 984	975 837	1 200 000
Public TVET Colleges	688 028	705 397	2 500 000
Community Education Training Centres	258 199	273 431	1 000 000
Private College Enrolments	187 354	168 911	

(Source: DHET 2019)

Majority of these enrolments in public HEIs were through contact mode,659 970 or 63.6%, while 377 014 or 36.4% enrolled via distance learning. The majority of graduates in public HEI graduates were in Science, Engineering and Technology (29.2% or 61 581), followed by Business and Management (27.4% or 57 772), Humanities (22.4%or 47 144) and Education (21.1% or 44 434). Private college enrolments grew significantly in 2017, as more private institutions opened (See table 5.24).

Table 5.24 Breakdown: no of institutions in the post-school sector

Post School Sector	**No.**
HED	26
Private HEI's	123
TVET Colleges	50
Private Colleges	279
Community Colleges	9

(Source: DHET 2019)

NSFAS allocated R14.1 billion during the 2017 academic year, which was 13.8% (R1.7 billion) higher than in 2016. The number of students who received NSFAS funding was 460 341 in 2017, reflecting a 2.0% (8 834) increase over 2016. The number of students who benefitted from NSFAS was higher for public HEIs (260 002 or 56.5%) as compared with TVET colleges (200 339 or 43.5%).

Table 5.25 Post-school sources of funding

Funding	2017
NSFAS	14.1bn
No of Students	460 341
HEI	260 002
TVET	200 339
Lushaka/Education	1.1bn
Funza	14 899
Skills Development Levy	16.2bn
SETA's	13bn
NSF	3.2bn
HEIs, TVET, CET	40.5bn
HEIs	31.6
TVET	6,7bn
CET	2,1bn

(Source: DHET 2019)

The funding budgets indicate how the government allocates spending on universities and colleges. R40,5 bn is allocated towards the post-school sector, while R14,1 bn and R16,2bn is allocated for NSFAS funding and the Skills Development Levy respectively. The average allocation for a TVET student is R30 000, while a university student gets R120 000 through NSFAS funding.

If we apply the allocation to the Mondragon example of 4 000 students based on the R31,6bn that government funds HEI's in South Africa, and allocate a proportional amount, the government funding allocation would be R121m. We know the cost range for degree-level education is between R100-R150k per month from our application of the Pollin & Callaci model. Using these two key costs, plus an estimation for private sector contributions which equates to at least double of that of government, the Mondragon co-operative model in South Africa could be estimated to require a minimum income budget of R963 pa (4 000 students). Compared to Pollin & Callaci (2019), it's a higher annual cost. Still, it is an ongoing system rather than a one-off payment, which would be improving the lives of future generations.

Table 5.26 Post-school gender profile

Year	Female	Male	Unspecified	Total
2011	54 160	48 876	n/a	103 036
2012	53 774	43 704	n/a	97 478
2013	64 335	55606	n/a	119 941
2014	73 776	65 431	3350	142557
2015	80 532	66516	162	147210
2016	91 493	73 801	2114	167 408
2017	105 983	77 754	1309	185046

(Source: DHET 2019)

Table 5.26 shows that the number of students enrolled in PHEIs in 2017 was 185 046, an increase of 10,5% compared to 2016. Since 2011 there has been an increase of 82 010 or 80% in students. There are a significantly more female students compared to male throughout the period. The increase in students in the private sector is likely due to limited infrastructure at public institutions.

Table 5.27 Student enrolment by mode and major field of study

	Science Engineering & Technology	Business & Management	Education	Humanities
Distance	25 543	53 849	58 722	78 721
Contact	216 836	115 562	58 839	145 491
Total	220 417	169 411	117 561	224 212

(Source: DHET 2019)

Table 5.28 Public higher education institution major fields of study

	Science Engineering & Technology	Business & Management	Education	Humanities
2009	41 511	33 818	34 523	35 532
2010	42 760	41 657	31 016	37 892
2011	46 100	44 155	32 484	37 879
2012	48 848	46 042	35 618	35 478
2013	53 176	49 051	40 384	38 212
2014	55 574	50 381	42 344	37 076
2015	58 090	53 863	42 917	36 654
2016	59 125	56 364	45 480	42 107
2017	61 581	57 772	47144	44 434

(Source: DHET 2019)

In South African universities, Science Engineering & Technology is the most prominent discipline, followed by Business & Management and Education and Training, which follows a common pattern in typical of developing countries.

Table 5.29 Public higher education institution major fields of study

Agriculture and Nature Conservation	364
Culture and Arts	9 470
Business, Commerce and Management Studies	113 287
Communication Studies and Language	9 575
Education, Training and Development	12 799
Manufacturing, Engineering and Technology	636
Human and Social Studies	7 625
Law, Military Science and Security	3 996
Health Sciences and Social Services	4 652
Physical, Mathematical, Computer and Life Sciences	17 017
Services	5 296
Physical Planning and Construction	329
Total	185 046

(Source: DHET 2019)

Compared to public universities, private HEI's have more of a business and education and training focus.

Table 5.30 Enrolment in TVET Colleges 2010 - 2017

Qualification Category	2010	2011	2012	2013	2014	2015	2016	2017
NCV	130 039	124 658	140 575	154 960	166 433	165 459	177 261	142 373
Rapport 191	169 774	222 754	359 624	442 287	486 933	519 464	492 026	510 153
Occupational Qualification	23 160	20 799	62 359	19 000	19 825	20 533	13 642	10 969
Other	35 420	32 062	95 132	23 371	29 192	32 424	22 468	24 533
Total	358 393	400 273	657 690	639 618	702 383	737 880	705 387	688 028

(Source: DHET 2019)

Table 5.31 TVET college by province

Province	No of colleges	Students
Eastern Cape	8	76 090
Free State	4	51 220
Gauteng	8	170 572
Kwazulu Natal	9	113 274
Limpopo	7	107 057
Mpumalanga	3	45 625
Northwest	3	32 317
Northern Cape	2	10 367
Western Cape	6	81 506
National	50	688 028

(Source: DHET 2019)

The data relating to TVET colleges would seem to indicate that there has been a lack of investment in vocational education facilities in Mpumalanga. For example, Limpopo province has a population of 5 million which is served by 7 colleges with a student population of 107 000. In contrast, Mpumalanga with a population of 4 million, has only 3 colleges with a student population of 46 000.

Table 5.32 TVET Report 191 programmes by study & gender

Rapport 191	Female	Male	Total	Female %	Male %
Non-national certificate	203	1004	1207	16.8	83.2
N1	19 414	31 342	50 756	38.2	61.8
N2	24 535	38 861	63 396	38.7	61.3
N3	22 479	32 823	55 302	40.6	59.4
N4	80 619	48 345	128 964	62.5	37.5
N5	69 257	39 566	108 823	63.6	36.4
N6	66 102	35 603	101 705	65.0	35
Total	282 609	227 544	510 153	55.4	44.6

(Source: DHET 2019)

Table 5.32 above indicate that there are more women than men at TVET colleges, and this gender dynamic should be factored in. Table 5.33 below highlights female students' top training choices.

Table 5.33 NCV enrolment in TVET colleges by gender

	NCV	Level2	NCV	Level3	NCV	Level 4	NCV	Level 2-4	Total
	F	M	F	M	F	M	F	M	Total
Civil Engineering and Building Construction	2200	2894	1119	1114	1201	1086	4520	5094	9614
Drawing Office Practice	24	80	15	29	10	23	49	132	181
Education and Development	1448	156	782	60	832	84	3062	300	3362
Electrical Infrastructure and Construction	4220	5161	2038	1851	1980	1753	8238	8765	17003
Engineering and Related Design	2802	5899	1567	2995	1631	2745	6000	11639	17639
Financial, Economics & Accounting	3278	1255	1580	469	1921	521	6779	2245	9024
Hospitality	3459	1077	1908	480	1717	406	7084	1936	9047
IT and Computer Science	1930	2090	876	830	888	814	3694	3734	7428
Management	2372	1132	1252	455	1161	416	4785	2003	6788
Marketing	2076	1293	1171	493	1137	529	4384	2315	6699
Mechatronics	185	261	135	161	165	142	485	564	1049

Office Administration	10357	2802	7276	1492	7170	1295	24803	5589	30392
Primary Agriculture	1406	687	738	403	725	360	2869	1450	4319
Primary Health	382	63	690	78	745	71	1817	212	2029
Process Instrumentation	0	0	0	0	0	0	0	0	0
Process Plant Operations	210	76	140	37	140	42	490	155	645
Safety in Society	1447	989	830	596	848	513	3125	2098	5223
Tourism	3044	1510	1532	644	1399	585	5975	2739	8714
Transport & Logistics	988	716	548	327	404	234	1940	1277	3217
Total	41988	28141	24197	12514	24074	11619	90099	52274	142373

(Source: DHET 2019)

Community Colleges

Nine new Community Education Colleges (CET) were opened in 2017, one in each province delivered through the Public Adult Learning Centre (PALS).

CET courses will be provided through Community Learning Centres (CLS), and the 3276 PALC's will be clustered under the CLC's to better manage governance and student leadership.

The colleges have seen a decline in the age of students. Therefore, the old offering of AET 1-3 and GET (ABET) at NQF1 will need to change to be more relevant. (DHET 2019) Youth are interested in Gr10, 11 and Senior Certificate and would like to rewrite their NCS. Interested learners are usually youth who can no longer be accommodated by the mainstream education system.

According to the DHET, there's a plan to pilot 54 centres and build CET partnerships in an effort to deliver on the NDP plan for 1 000 000 learners by 2030. The DHET is said to be open to innovate programme delivery.

5.2.8 Feasibility of a Co-operative University in Mpumalanga

The following discussion explores the 'Mondragon' co-operative university model as a concept in South Africa, using the post-school landscape data from the previous section. Note that the concepts of working students paying for their studies, and guaranteed work will be applied.

The preceding analysis showed that although there is consistent growth in enrolment in HEI's and TVET's, the private HEI market is growing exponentially. The degrees offered by public HEI's are focused within STEM (Science Technology Engineering and Maths), Business, Education and Humanities. At private HEI's the focus is mostly on Business, followed by STEM subjects.

There does not seem to be a focus on mixed green economy qualifications at private HEI's which may be a gap in the education sector, one that a co-operative university could potentially accommodate. There is a strong contingent of female students in both HEI's and TVETs respectively 57% and 55,4%. Yet the career choices of female students do not seem to be orientated towards STEM or energy and include Office Administration. Hospitality, Tourism, Finance and Accounting and Education and Development. The focus on TVET colleges as a 'feeder' system matters as the Mondragon examples highlights the importance of where student seeking degree qualifications in Energy Science come from. Clearly, female learners need to be targeted earlier on their educational journey to encourage them to move into the energy sector.

The annual cost of a co-operative university can be estimated as follows:

Table 5.34 Cost estimate of a co-operative university in SA

Funding/Income Sources	**Amount**
Student Fees 4 000x R150 000	600m
Government funding based on current HEIs budget adapted for 4 000 students	121m
Private sector funding	242m
Total	963m

(Source: DHET 2019)

As mentioned in the analysis of the post school system above, the student fees are based on R100-R150k per month retraining costs (for degrees) in the application of the Pollin & Callaci (2019) model, while the HEI funding in the post-school landscape analysis was used to determine government's contribution. Using these two key costs, plus an estimation of private sector contributions, the Mondragon co-operative model in South Africa is estimated at R963pa for 4 000 students. Compared to retraining costs in the Pollin & Callaci (2019) model application, it's a higher annual cost. Still, it is a perpetual system rather than a once-off retraining cost . It applies well to future generations, which is the approach that has been widely recommended by the contextual analysis in the previous section.

The planned community education college centres, which, according to the DHET are open to innovation in programme delivery, may be an avenue for a partnership to generate a feeder channel for future students given the changing profile of community colleges as youth education centres. This is a space where foundational skills can be restored through remedial education and an orientation towards STEM careers.

5.2.9 Chapter Summary

This chapter combines quantitative and qualitative methods to provide a more detailed account of a supportive just transition approach for coal workers and the community of Emalahleni. It outlines the costs of a just transition and places emphasis on retraining, rehabilitation and regional economic development and highlights the value of partnerships and collaboration. In the following chapter, these key strategies are summarised, and recommendations will be made. Detailed, context-based approaches highlight the challenges and vulnerabilities that coal communities face in an unjust world described as follows:

> I was in the Cape recently walking through the V& A Waterfront looking at all those beautiful lights saying to myself about 80% of the power generated to illuminate this beautiful place comes from this crummy place that I come from little wonder there is so much social unrest in this area. I heard this morning the N12 was blocked again…(Venter 2019)

Chapter 6: Recommendations and Conclusion

A global transition to a low carbon economy is underway, driven by reduced costs of renewable energy technologies worldwide (Burton et al. 2018; Swilling 2019). In South Africa, a transition away from coal is progressing as export sales decline, and coal-fired power stations are decommissioned to mitigate emissions. The ANC NEC endorsed the need for a just transition prior to the recent release of the IRP. However, a detailed, just transition implementation plan needs to be worked out to manage the impact of the transition, especially as they relate to potential losses. The high-level support of the ANC presents a political opportunity to unlock the necessary resources to manage this transition. This support could broaden the reach of a just transition and result in positive transformative change.

A supportive, economic just transition approach is required to carefully manage the impact of South Africa's transition in the context of high unemployment and skills shortages. In response to the research questions, this study has found that attrition programmes are effective and have shown measurable results in reducing unemployment. The following framework outlines the effect of attrition scenarios on contraction, job losses, retraining and re-employment in South Africa, which has implications for costs. The original model by Pollin & Callaci (2019) aims to achieve an 83% attrition rate through retirement, i.e. a higher number of workers that retire naturally (Row E) as a % of the no of workers that need to exit the industry (Row C).

Table 6.1 Attrition by retirement and coal job losses: SA coal workers (over 20 years)

		High Attrition *Scenario one*	IRP Decommissioning *Scenario two*
a	Contraction rate	43%	75%
b	Current employed total	82 248	82 248
c	Job losses over 20-year transition	35 367	61 686
d	Average job loss p.a.	1 769	3 085
e	Workers between 45 and 65 (35%)	28 787	28 787
f	Workers per year reaching 65	1 439	1 439
g	Workers u/45 p.a. req. re-employment	330	1 646
h	Total u/45 req. re-employment/20 yrs.	6 600	32 920
i	Re-employed workers as % of job losses	18%	54%
j	Attrition as a % of job losses	82%	46%

(Source: Model: Pollin & Callaci 2019, SA application by author)

The framework shows that an increase in contraction results in more workers requiring retraining and re-employment (indicated in Row H in Table 6.1 above).

At the currently forecast contraction rate of 40% (IKI 2019) over 30 years, the attrition is within a 'protective' range. If the contraction rate accelerates dramatically for economic or other reasons, it is still possible to manage the transition with a supportive approach focusing on retraining and re-employment.

South Africa still needs to develop a concrete, just transition implementation plan. While the ANC is now publicly committed to a just transition in principle, any delay in its implementation will increase costs as education, salaries and rehabilitation costs rise. This research estimates the annualised, and total cost, of a just transition in South Africa over a 20 year period. It is a basic calculation using available national data. The total cost is within the range of just transitions in other countries which are between R1,2bn to R5bn. The cost of a just transition in South Africa has not been calculated before. Note that compensation costs are recommended for a period of five years. This cost estimate is in response to the second research question.

Table 6.2 Summary of just transition costs in SA

Costs	**High attrition Scenario (Total)**	**High attrition pa**	**Decommission Scenario (Total)**	**Decommission Scenario pa**
Compensation	1 200 000 000	60 000 000	6 000 000 000	300 000 000
Retraining	621 000 000	31 050 000	3 200 000 000	160 000 000
Relocation	100 000 000	5 000 000	500 000 000	25 000 000
LED	4 000 000 000	200 000 000	6 000 000 000	300 000 000
	5 921 000 000/6bn	296 050 000/300m	15 700 000 000/16bn	785 000 000

(Source: Application by author)

The context-based qualitative component of this research presents the community's understanding of a just transition. This expands on the literature analysis in response to the question of what a just transition is. Communities emphasise the creation of jobs via rehabilitation and the expansion of renewables and look to a just transition to resolve pollution. In addition, they favour community ownership of renewables.

It revealed how communities in coal mining areas are self-organising and how trust is growing between communities, CBO's and unions. The organisation of energy democracy movements is vital to successfully negotiate the terms of a just transition. Therefore, the emerging social-democratic movements in Emalahleni and surrounding areas need to strengthened. The observations were instrumental in selecting key strategies for South Africa.

Key Strategies

Social Dialogue & stakeholder engagement

The single most pertinent theme that featured in all research was the need for social dialogue and stakeholder engagement across key stakeholders including government, unions, coal workers, coal companies, green sectors, communities, relevant CSO's and academics. Project 90 by 2030 (2019) recommends a combination of a top-down and bottom-up approaches so that all institutions can be strengthened and be included in decision making forums.

Health & clean air

While the Emalahleni community is disposed towards a just transition, they are torn between the competing need for jobs and clean air. As one community member stated; "hungry air is clean air". This potentially divisive reality for community members needs to be considered when managing and mediating social dialogues. Health and safety concerns need to be included in advocacy campaigns and policies for a just transition.

Education partnerships for future generations

The research shows that tertiary education improves employability and that future industries will need high skilled workers (GroundUp & SKI 2019). Although coal workers have a minimum of matric and are trainable (Venter & Bam 2019), only 17% have a degree. The analysis of the post-school system shows that Science-related, Business and Education disciplines are growing, and female student enrolment is on the rise (DHET 2019). It has also shown that there's potential for a vocational university, supported by public-private partnerships which could be a sustainable vehicle in Mpumalanga to help resolve educational challenges and address employment issues.

The Mondragon University co-operative model is based on a public-private partnership but is unique because students pay their fees as they are employed, thereby contributing to costs. Furthermore, the research showed that a just transition should be extended to the next-generation of Mpumalanga's workforce (Levington & Montpassen-Clair 2019). However, there are indications that foundational skills are likely to be a challenge (Levington & Bam 2019). To address this need, the post school landscape analysis showed that community colleges are becoming spaces for educating youth and that the DHET is open to partnerships.

Finally, the SARETEC and Northlink College/Gwent partnerships provided insight into the shape of innovative energy partnerships that include SETAS, TVETs, global funders, global education partners, local funders, local education partners, business support institutions and employers and illustrate what can be achieved through education partnerships.

Sectoral & regional development partnerships

This study shows that bridges to employment and the development of employment opportunities assisted countries like Germany, the Netherlands and Canada to create ongoing employment. This highlights the need for sequenced sectoral and regional development policies. While RE development appears to be on the horizon in Mpumalanga through the REDZ (Renewable Energy Development Zones) initiative (Engineering News 2019), energy experts have cautioned that a more mixed green economy may be more effective in creating alternative jobs (Levington & Montpassen-Clair). The concentration of coal workers in the Nkangala and Gert Sibande municipal districts needs to be considered when planning regional development. Finally, the analysis of the lessons learned from the REIPPPP and its associated LED programmes highlights the importance of public-private partnerships and the need to integrate RE and LED.

Focus on gender dimensions

The risk of gender imbalances as the sector transitions are very real (ILO, Pollin & Callaci 2019, UNFCCC 2016 & EUSP 2019). The fossil fuel industry in South Africa is predominantly 84% male (Anglo SLP 2016). However, it is estimated that the clean energy sector will consist of 30% of women. While this still falls short of parity, is does represent a

significant shift. These particular dynamics need to be understood, and policies implemented to promote gender equality and equal access to opportunities.

High-level buy-in

The research highlights the importance of high-level buy-in by government. For example, in Canada both the prime minister and minister of environment championed a just transition (Zinecker et al. 2018). The Canadian Just Transition task force made recommendations that the government was seen to 'act on' which helped to shape policies and unlock funding.

Investment in a just transition

The most significant costs outlined in the model applied to South Africa are retraining, rehabilitation and regional development. Research shows that it is more cost-effective to train workers while they are still employed. This allows for access to funds from SETA's via the Development Levy to cover the cost of training. It is recommended that this is pursued through a programme similar the Energy Utility Development Skills initiative in the UK (EUDS 2019). The Sector Job Resilience Plans (SJRP) and National Employment Vulnerability Assessment (NEVA) may contain useful sector data to supplement these plans but also present an avenue to co-ordinate skills development on a national level.

The highest cost is rehabilitation and regional development, which will need substantial support from national and local government, private industry, development funding and potentially other mechanisms like carbon or coal taxes. Pollin & Callaci (2019) show how coal taxation was successfully used for mine rehabilitation in the US. However, they caution that the reduced sale of coal can impact on this source of funding. The research highlighted the cost of SEZ's to indicate the level of support and investment that the government needs to make in key regions. These investments are in the range of R4bn.

Re-Integration of migrant labourers

An analysis of 'sending areas' in SLPs from mines in Mpumalanga indicates that 17% of mineworkers migrated from neighbouring provinces. This presents the possibility of re-uniting these workers with their families through relocation packages during transitions. This

means that the footprint of employment partnerships may need to be extended into surrounding provinces.

Securing Pensions

In South Africa, a significant number of mining companies have invested pensions into collective funds such as the MPF. Pollin & Callaci (2018) argue that pensions need to be guaranteed within their just transition framework. They recommend that pension shortfalls should be managed and that the government has a role to play in ensuring that funds and mechanisms are secured. While the research shows that pensions in South Africa appear to be secure, recent investment strategies and the tendency for new mining houses to have majority contract workers suggests that there are very real risks that need to be managed. Regulation of funds and company policies will likely need to be reviewed.

Concluding Comments

This research explored supportive, just transition strategies. Although an established body of just transition literature offers multiple approaches, frameworks and practical case studies that can inform a managed transition, labour losses, can at best be mitigated by a thriving economy. Possible strategies include sectoral alternatives and robust regional development strategies as well as smoothed, management strategies such as attrition or early retirement. South Africa is on the backfoot when it comes to skills development plans in the energy and green economy sectors, making it challenging to identify opportunities and match skills and opportunities and exact costs for industries in transition. However, this research has tried to identify alternatives for coal workers in transition and to scope the related costs. To be able to determine accurate costs and manage a transition effectively, alternative sectors need to be identified, and potential partnerships and working relationships need to be established with these alternative sectors. To be able to affect a just transition as the material conditions align to political will, choices will need to be made about who will benefit in efforts to empower future generations for the green economy in a sustainable way. Locally owned green energy co-operatives and innovative education centres are empowering vehicles in energy democracy. Further strengthening emerging, local energy democracy movements while recognising the conceptual dimension of law in coal mining geographies will likely enable

the necessary procedural mechanisms, laws and commissions to be better able to negotiate a just transition. Finally, the complex political economies, typical of countries in the global south, require a deeper understanding of the stakeholders affecting energy transitions.

Further research focused on the South African political economy would be useful to understand relationality and how to manage these dynamics in an informed way.

This research relied on limited contextual data, which was either unavailable (in the case of the SJRP and NEVA) or mining companies were unwilling or unable to share. The full co-operation of the mining sector, unions and government would lead to more accurate scoping and better management of coal workers' livelihoods. Additional further areas of research could include an energy sector skills development plan that integrates with a green economy skills development plan.

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Appendices

Appendix A: UNFCCC Just Transition Framework/Questions

Understanding the employment impacts of a Just Transition

1. Is the provision of a just transition of the affected workforce included in the signed document?

2. Is the ministry of labour involved throughout the entire process?

Early assessment of the impacts

3. Which method and modelling tool should be used for the assessment?

4. Is there sufficient data available for the assessment?

Consultation and social dialogue

5. Who are the participants in the dialogue?

6. How should the result of their dialogue affect decision making?

Training and Skills Development

7. What are the skills needed?

8. Can the need be covered with the affected workers through training?

9. Are there enough resources for the training?

Social protection and security

10. What are the needs for the affected workers and their families?

11. Are there social protection measures in place?

Post assessment

12. Was the transition successful?

13. What are the lessons learned?

Appendix B: Institutional Permission Request Letter

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Institutional Permission Request Letter

Name & Address:	Anglo Coal, 55 Main Street, Johannesburg
Contact Person:	Jon Samuel, Group Head: Social Performance and Engagement
Contact Number:	011-638 9111
Email Address:	jon.samuel@angloamerican.com

Title of Research Project:	Exploring the usefulness of a just transition in mitigating the risk of labour losses in SA's energy transition
Researcher:	Michelle Cruywagen
Dept Name & Address:	Faculty of Economics and Management Sciences, Stellenbosch Central, Stellenbosch, South Africa, 7599.
Contact Number:	079 5140283
Email Address:	michibeanie@gmail.com

Dear Mr Samuel,

Kindly note that I am an MPhil. Sustainable Development researcher at the Department of Economics and Management Sciences at Stellenbosch University, South Africa and I would appreciate your assistance with my research, herein referred to as The Just Transition Scoping Survey (JTSS).

Please take some time to read the information presented in the following five points, which will explain the purpose of this letter as well as the purpose of my research project, and then feel free to contact me if you require any additional information.

1. **Introduction:**

   Reliable data is required to provide insights and inform company decisions to swiftly mitigate risks during times of transition and sustained crises, as is currently faced by the South African energy sector. Preliminary research has shown that gaps exist in data needed to plan for a 'just transition'. Further to this, as an unplanned transition potentially gains momentum, threats of job losses and potential unemployment are an understandable concern for companies, unions, researchers and policymakers.

   The proposed study uses a 'Just Transition Framework' approach by Pollin & Callaci (2018), which is based on taking a long-term view in managing energy transitions. This is essentially a 20-year approach, which allows workers to retire naturally through a process of attrition and then recommends proactively managing the process of reskilling and supporting alternative employment opportunities for younger workers.

This is an independent scoping study which is being conducted by myself as a master's student as an academic exercise. Each company participating in this survey will ultimately be exposed to this method and findings and choose their own strategic approach and direction. This study is not a reflection of your company's approach, strategy or future policies. However, as a participant you will be exposed to the methods and hopefully benefit by the findings which could be shared with Anglo Coal.

2. **The purpose of the project:**

   The Just Transition Scoping Survey (JTSS) is a research study, designed to scope the cost of a planned and fair transition for employees in the coal sector and focuses on the mitigation of labour risks in South Africa, which is increasingly impacted by the global energy transition to a low carbon economy.

   The data obtained from this labour cost scoping survey, could potentially contribute to a national, economic 'just transition' framework which can assist the Coal sector to create long term plans, better manage the transition, assign responsibilities and establish appropriate and collaborative sector-wide compensation mechanisms. This approach is in the interest of avoiding the cost of retrenchments and the need to absorb sudden shocks.

3. **Your assistance would be appreciated in the following regard:**
   To be able to conduct the national JTSS, I would like to request permission from Anglo Coal to collect labour data. The specific types of data have been outlined in more detail in the attached JTSS questionnaire. Where possible kindly advise the most suitable representative to contact. To be able to obtain the most accurate data, we would prefer to contact Anglo Coal directly and not rely on limited data that is available in the public domain.

4. **Confidentiality:**
   The data being requested is of a de-personalised nature i.e. does not allow for the identification of individuals and should therefore, not pose a risk to Anglo Coal employees. The raw data will not be shared with companies participating in the study. Once the study has been consolidated and de-linked from your organisation, permission will be requested on a case by case basis if the research data is to be used for national planning in the interest of a Just Transition. The data will be stored on a secure password-protected laptop computer and will be accessed by myself.

5. **Timeframe of research project**
   The research will be conducted during April and May 2019 and during this period I will need access to institutional data.

If you have any further questions or concerns about the research, please feel free to contact me via email at michibeanie@gmail.com or telephonically on 0795140283. Alternatively, feel free to contact my supervisor, Mark Swilling via email swilling@spl.sun.ac.za or telephonically on 021-808 2704 or 083 459 7417. Thank you in advance for your assistance in this regard.

Kind regards,

Ms Michelle Cruywagen

Principal Investigator

Appendix C1: Just Transition Scoping Survey

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JUST TRANSITION SCOPING SURVEY: COAL SECTOR

Purpose of this Study

Effective planning and proactive management are crucial to navigate potential business risks in energy transitions and these mitigation strategies need to be informed by up-to-date economic research. The proposed national study aims to scope the cost of a 'just transition' based on a framework designed to support workers in energy transitions. Research in South Africa has indicated that there's insufficient data available to mitigate labour losses, therefore this study aims to address data gaps.

Respondent Details

Name & Surname:	Ayanda Bam
Designation:	Director
Company:	Kuyasa Mining (Pty) Ltd
Years at Company:	24
Date (D/M/Y):	Click or tap to enter a date.

Employee Data

1.	How many employees work at Kuyasa Mining?	385
	1.2 How many are under 45?	244
	1.3 How many are between 45-65?	141
	1.4 How many will reach 65 in the next 20 years?	245

1.5 What is the % split between permanent and contract workers?

Appendix C2: Just Transition Scoping Survey

Permanent 91% Contract 9%

2. At what age are employees required to retire? 63 & 65
3. What's the gross earnings of your coal employees in Rand? 108 209 524
4. How much of their total earnings contribute to pensions? 69 920 000
5. How many employees are:

Skilled 130

Semi-skilled 197

Unskilled 58

6. What is the consolidated salary breakdown between skilled, semi-skilled and unskilled?

Skilled 55 753 948

Semi-skilled 42 363 448

Unskilled 10 092 126

Production growth rates

7. What do you forecast the Coal sector's annual (production) growth (or contraction rate) to be? Indicate growth with a (+), decline with a (-) and the rate as a %

2019-2020 0 %

2020-2021 0 %

2021-2022 0 %

Average over next five years

Geographical Location

8.1 Where are your company's **coal** sector employees located geographically?

Appendix C3: Just Transition Scoping Survey

Please provide the name of the area and distance in relation to the nearest town e.g. Delmas, Emalahleni

Mining area 1	Delmas Coal	No of employees	385
Mining area 2		No of employees	
Mining area 3		No of employees	
Mining area 4		No of employees	
Mining area 5		No of employees	

8.2 Total no. of employees located in Mpumalanga: 385

9. Besides coal mining, which alternative sectors offer employment within your employees' geographical location? (Pls make a X and describe for 'other')

9.1.1 Mpumalanga

Agriculture	☒
Education	☐
Mining	☒
Manufacturing	☒
Utilities	☒
Construction	☐
Trade	☐
Tourism	☐
Transport	☒
Finance	☐
Communication	☐

Pls specify type (s) of mining: Silica & building sand; Coal

Appendix C4: Just Transition Scoping Survey

State service ☒
Private Housing ☐
Other

9.2 What is the overall state of the local economy where employees work? (Pls tick)

9.2.1 Mpumalanga

growing ☐
stagnant ☐
in decline ☐
stable ☒
comments

9.3 Which essential community services do your employees make use of? (Please tick OR describe under 'other')

Schools ☒
Churches ☒
Hospitals ☒
Clinics ☒
Retail ☐
Other

10. Pension Fund

10.1. To which pension fund do staff contribute: Kuyasa and Mineworkers Provident Funds
10.2 How is the fund managed e.g. Board of Trustees? Umbrella Funds with Committee
10.3 Describe the state of your company's pension fund by ticking the box below:

financially healthy ☒
has unfunded liabilities ☐
able to meet future obligations ☒
not able to meet future obligations ☐

Appendix C5: Just Transition Scoping Survey

not sure ☐

10.4 Has the pension fund made dividend pay-outs in the past 3 years? Kindly indicate with a tick below.

Yes ☐

No ☒

8.5 Which laws are applicable to the governance of your company's pension fund?

Pension Fund Act ☒

Income Tax Act ☒

Labour Relations Act ☐

Mineral and Petroleum Resources Development Act (2002) ☐

8.6 Please comment on the future value of the pension fund?

Employee Retraining

9.1. Is your company engaged in a staff retraining programme to increase employees' resilience in the transition to a low carbon economy?

Yes ☐

No ☒

If yes, please describe the programme

The company is in the carbon economy and believe that those who want to stop or curtail carbon economy should provide for the retraining of affected employees.

9.2 What is the planned cost of retraining in Rand?

9.3 List the skills being considered for employee retraining

9.4 Has your organisation conducted an audit of skills?

Appendix C6: Just Transition Scoping Survey

Yes ☒

No ☐

If yes, please indicate willingness to share this information?

Yes ☐ If yes, pls provide an email contact for this data

No ☐

Summary of skills audit findings

9.5 Are you aware of any existing corporate or government fund (s) designed to assist coal workers with compensation in transition to a low carbon economy?

Yes ☐ If yes, pls provide a name of the fund

No ☒

9.6 Can you provide a recent breakdown of education levels of staff (e.g. no schooling, ABET 1-4, FET phase, Diploma/Certificates, Undergraduate Degree, Honours, Masters)

Yes ☒ If yes, pls email the excel sheet to michibeanie@gmail.com

No ☐

Note: if the data is only available for each mining region i.e. not consolidated, pls send the breakdowns anyway.

Sustainability

What is your companies' current commitment to climate change mitigation?

None

What is your organisation's current C02 emissions?

Additional Comments

Feel free to add any relevant comments to this scoping survey

Appendix D: Consent Form

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Stellenbosch University
Consent to participate in Research

You are invited to take part in a study conducted by Michelle Cruywagen, from the Economics and Management Sciences Department at Stellenbosch University. You were approached as a possible participant in the interest of mitigating management risks in energy transitions.

1. PURPOSE OF THE STUDY

Effective planning and proactive management are crucial to navigate potential business risks in energy transitions and these mitigation strategies need to be informed by up-to-date economic research. The proposed national study aims to scope the cost of a 'just transition' using an approach designed to support workers in energy transitions. Research has indicated that there's insufficient data available to mitigate labour losses, therefore this study aims to address this gap.

2. WHAT WILL BE ASKED OF ME?

If you agree to take part in this study, you will be asked to provide labour data (e.g. age breakdowns, salaries, pension contribution, skills, geographic location) and optional participation in a semi-structured 1-hour interview at a convenient location or via Skype. Support of the national study, through written endorsement and further connection to key contacts within your organisation would also be appreciated. At times, assistance may be required to ensure that data is provided via internal communication channels.

3. POSSIBLE RISKS AND DISCOMFORTS

While the study is in the interest of a 'just transition' and support for employees, the request for labour data may be met with concern. I therefore recommend that the study would need to be positioned as being in the interest of employees in a transparent and empathetic manner. If you require further assistance, a guiding narrative script can be provided.

4. POSSIBLE BENEFITS TO PARTICIPANTS AND/OR TO THE SOCIETY

This national study is in the interest of planning to mitigate the risk of labour losses in energy transitions. Research has shown that data gaps exist, and this study will potentially contribute to addressing data gaps. As a participant, you will be able to directly contribute to this study. This study will give you exposure to a proposed approach and the labour data needed to be able scope and mitigate risks. If you are interested, the analysis and findings could be shared with you and may be able to assist Anglo Coal's planning and mitigation efforts.

5. PAYMENT FOR PARTICIPATION

Note that this study is not sponsored by any company or institution and no participants will receive compensation in any form for participation.

6. PROTECTION OF YOUR INFORMATION, CONFIDENTIALITY AND IDENTITY

Any information you share with me during this study and that could possibly identify you as a participant will be protected. This will be done by not identifying participants or organisations, unless they explicitly indicate that identification is acceptable, storing data in a company folder on a password protected desktop that is only accessed by myself at my home.

The information will be released and shared with my supervisor and examiners for evaluating my Masters. The information will not be released to any other party/agency for any other reason, without prior notification during which you will be given the option of opting-out of the information being shared. In the event of the information being used for future publication and other purposes, prior permission will be sought.

Audio and video-recorded interviews will be accessible, and you will have the opportunity to review and edit these if you require. These will only be stored in your company folder on my desktop and can be erased if required.

7. PARTICIPATION AND WITHDRAWAL

You can willingly choose to participate in this study. If you agree to take part in this study, you may withdraw at any time without any consequence. You may also refuse to answer any questions you don't want to answer and remain in the study. The researcher may withdraw your company from this study if you do not meet the essential data requirements.

8. RESEARCHERS' CONTACT INFORMATION

If you have any questions or concerns about this study, please feel free to contact Michelle Cruywagen at 079 514 0283 and/or the supervisor Mark at swilling@spl.sun.ac.za

9. RIGHTS OF RESEARCH PARTICIPANTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research participant, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

DECLARATION BY THE PARTICIPANT

As the participant I confirm that:

- **I have read the above information and it is written in a language that I am comfortable with.**
- **I have had a chance to ask questions and all my questions have been answered.**
- All issues related to privacy, and the confidentiality and use of the information I provide, have been explained.

By signing below, I _____ *(name of participant)* agree to take part in this research study, as conducted by _____ *(name of principal investigator).*

_____ _____

Signature of Participant **Date**

DECLARATION BY THE PRINCIPAL INVESTIGATOR

As the **principal investigator,** I hereby declare that the information contained in this document has been thoroughly explained to the participant. I also declare that the participant has been encouraged (and has been given ample time) to ask any questions. In addition, I would like to select the following option:

	The conversation with the participant was conducted in a language in which the participant is fluent.
	The conversation with the participant was conducted with the assistance of a translator (who has signed a non-disclosure agreement), and this "Consent Form" is available to the participant in a language in which the participant is fluent.

_____ _____

Signature of Principal Investigator **Date**

Appendix E: Emalahleni Community Observations

Community observations, hosted by GroundWork , were conducted in Emalahleni on 19 July 2019. Respondents included coal mine workers, union representatives, community members and local NGO's. The meeting took place on the auditorium's stage at the Civic Theatre. The following photographs feature Sizwe Tyiso of Naledi (National Labour and Economic Development Institute), Host: David Hallowes (GroundWork), Norman Makoena (COSATU), a female participant living in the area, a man who lost his job in the mining town of Hendrina and Robbie Mokgalaka (GroundWork) and Promise Mabilo of Vukani Environmental Justice Movement.

Appendix F: Kuyasa Coal Interview: Emalahleni

Meeting with Ayanda Bam, CEO of Kuyasa Mining, Emalahleni on 18 July 2019 at Kuyasa's head office. Kuyasa's mines are located in the town of Delmas.

Appendix G: Emalahleni Observations

Observations between Middleburg & Emalahleni 19 July 2019.

Appendix H: Definition of Skills Levels

Low Skill Workers

Low-skilled workers are persons with limited skills and lower educational attainment, e.g., a matric certificate or lower. These employees perform work that does not require specialised experience. This category includes truck drivers, cleaners, gardeners and those employed in rudimentary tasks (KPMG, 2017).

Semi-Skilled workers

Semi-skilled workers are persons with basic training, knowledge and experience necessary to complete specific tasks, but who lack specialised skills. These employees would have some form of post-secondary school training. This category includes, entry-level administrative workers and customer service representatives. KPMG (2017) notes that this category includes plant and machine operators and assemblers at Eskom stations.

Skilled and high skilled workers

Skilled and high-skilled workers are persons with a specialised skillset required to complete a specific task, and will most often have completed tertiary education (either vocational training or university education). This category includes white- and blue collar professions, including administrative workers, electricians and lab technicians, computer programmers and lawyers.

Source: IKI 2019